Managing Information Exchange

A Case Study at ZF Friedrichshafen AG

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Managing Information Exchange by Improving Information Flows in a Customer-to-Customer Process

A case study with ZF Friedrichshafen AG

Master thesis submitted to Delft University of Technology

in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

in Management of Technology

at Faculty of Technology, Policy and Management

By

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Project duration: March 10, 2019 ï August 30, 2019

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Preface

This report is the outcome of six months of study done together with ZF Friedrichshafen AG, Schweinfurt. It is meant for anyone interested to understand process integration principles to manage information flows in business processes in an industrial setting. Basic knowledge of supply chain flows is required to understand the context of information flows, although, all necessary information is already mentioned in the thesis, complete negligence of knowledge of supply chain flows may affect the understanding. This report would be interesting for people having an affinity towards process engineering, business process management, and similar areas.

The style of writing and content of the report is kept very simple and easy. It makes possible for anyone irrespective of supply chain management background to easily understand and follow the report. The original transcripts used for empirical analysis are not presented in the report, but all the findings have been summarized sufficiently to make the user understand the derivation of results. However, if needed the transcripts can be produced on request. The crux of the thesis lies in developing a framework that helps to improve information flows in business processes and modeling the design with collective stakeholder participation.

This thesis can be divided into four phases: definition and analysis, design, validation, and recommendations. The thesis starts with problem introduction in the first chapter, followed by definition and analysis phase that includes the development of a theoretical framework based on literature and empirical analysis based on interviews and observation at the case company. The second phase of the thesis is design; it includes the participatory discussions for collective solution development for the problems at the case company. The design developed is evaluated during the design validation phase, an expert panel evaluates the design based on the framework developed during definition and analysis and updating the design as per suggestions. The final phase involves recommendations to the managers of the company. It includes the implications of design, implementation plan and future next steps. To have a quick overview of the overall work done in this thesis, the Executive Summary and chapter 7 would be helpful. The last chapter of the thesis is lessons learned by the author during the period of research.

Shivam Srivastava
Schweinfurt, August 2019

Acknowledgments

This thesis concludes my M.Sc. in Management of Technology at the Department of Technology, Policy, and Management at the Delft University of Technology and I cannot be happier. When I look back, I feel glad about my decision to take up the opportunity to write my master thesis with ZF AG at Schweinfurt. My reason to take up this thesis was my personal drive to study and apply my theoretical knowledge to a practical world. I wanted to challenge myself with something different and this was it ï the domain, methodology, the field of theory was completely new to me. To be honest, it was a roller coaster ride all across ï from sleepless nights to intensive skype calls discussions to being completely blank about what to do next and now I am here writing this. This was not possible without the squad of people supporting me.

First, I would like to give sincere thanks to my supervisor Marcel Ludema at TU Delft and Holger Krull at the company. Marcel has been inspiring me ever since my first horrible draft of thesis proposal. You made me realize that I was on track during every meeting, kept on inspiring me to push myself to find creative ideas or methods. Holger on the other hand, facilitated everything I needed for my thesis, giving me time out of busy schedule and allowing me to disturb any moment I wanted. I was lucky to have such a wonderful manager supervising me. I am also very thankful to Dr. Tina Comes, who has been so patient and kind to help me find my errors and giving precious suggestions all the time. I admire your direct approach and critical reviews, it such a huge help to me to assess my work. My chair, Prof. Lori Tavasszy, has been really understanding and helpful during all my meetings and discussions. Your constructive feedback helped a lot and I could not ask for more.

I would like to extend my thanks to all the interviewees from Schweinfurt and Pune, who in their busy schedule took time to help me with my research. I am grateful to the logistics department at Schweinfurt who have helped me a lot, especially Simon Müller. Coming to my dear ones, my parents who are always more enthusiastic about my work than I ever do, were the real reason I made this far. Their incredible support and cooperation have inspired me all across. Golu and Deepali, thanks to both of you for always being there and supporting me as always.

Shivam Srivastava
Schweinfurt, August 2019

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Short Summary

This thesis aims to manage information exchange at the case company by designing an information exchange map using a business process model for the customer-to-customer process, together with structuring team meetings and creating ground rules for efficient information exchange. The Damper Division of ZF Friedrichshafen AG (case company), Schweinfurt (SCW) has recently decided to move the production of its high running parts to its facility in Pune, India. The project is facing typical Supply Chain Management challenges like delay in serial production and delivery schedules, lack of information exchange, ambiguity over roles and responsibilities, and redundant communication between the two facilities SCW and Pune, thus incurring a high transaction cost and low coordination.

The literature review about information flows, business processes and process integration provided four principles that help to integrate the information flow between processes. These principles are ï accessibility, transparency, granularity, and timeliness. Further, these principles were used to structure the interviews with the stakeholders of the project and participatory observation during the team meetings. The analysis pointed that there are information gaps and interrelationship issues between the stakeholders of the project. The issues identified were the need for an information exchange map which can be relied on by all of the stakeholders, timely information exchange, defined responsibilities and roles, and efficient communication.

Standardization of information exchange with the help information exchange map together with information sharing rules emerged out as the main conceptual design. This was followed by a participatory design phase where the design was developed together with the stakeholders of the project. These group discussion highlighted the points of concerns and agreements between the stakeholders. There were three such discussions ï two for design development and one for validation.

The final design with information sharing rules (meeting structure and ground rules) were validated by an expert panel of functional managers and was evaluated based on the four principles of - accessibility, transparency, granularity, and timeliness.

Based on the final design, a set of recommendations (including an implementation plan) were laid out to help the managers steer the final design to the best of their use. Currently, the case company is about to implement the design together with the meeting structure and ground rules. It was recommended that the future objective of the company should be to achieve a control tower for central data collection and using the data to generate insights.

The empirical analysis was limited as the majority of the stakeholders were not collocated. Also, the proposed meeting structure is limited to use for this project while information flows and grounds rules can be replicated in a similar scenario.

Extended Summary

Introduction

Transaction cost theory (Williamson, 1985) & (Williamson, 1981) mentions that the decision to make or buy goods or services depends not only on the market price of the commodity but also on the involved transaction costs. The transaction cost can be referred to as the cost incurred to coordinate people and machines to perform a process (Williamson, 1985) & (Williamson, 1981). Firms often try to minimize their transaction cost as much as possible by minimizing coordination costs and increasing operational efficiency to make the disaggregation of value chain successful (Ganesan, George, Jap, Palmatier, & Weitz, 2009). This thesis focuses on managing the information exchange of a project at the case company by improving the information flows associated with the activities in a customer-to-customer process and thereby, inducing high coordination and reducing transaction cost for the case company.

Problem Description

This thesis involves a case study at Damper Division of ZF Friedrichshafen AG, Schweinfurt (SCW), which has recently decided to move the production of its high running parts to its facility in Pune, India. The project is still in its starting phase but several challenges make the coordination difficult between the two facilities SCW and Pune, thus incurring a high transaction cost and low coordination. It is evident by the fact the project has already missed important deadlines and the start of the production has been delayed significantly. It was found that the business processes are not defined for the new customer-to-customer process, as not everyone is aware of the activities performed in Pune or SCW. Additionally, another major challenge is the improper information exchange between the two teams leading to problems like no clear visibility on information flow, and no clear understanding on roles and responsibilities of the stakeholders involved in the process.

The issues reported also relates to the typical challenges like lack of information sharing leading and operational inefficiency addressed in Supply Chain Management (SCM) literature. All the issues for information exchange discussed above lead to an overarching objective of this thesis.

Design objective: *"To design an information exchange map using a business process model to improve information flows between the processes in the customer to customer process for the logistics departments of the case company."*

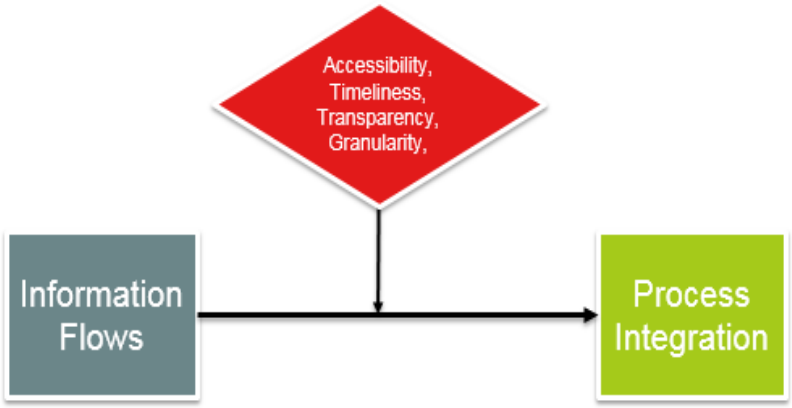
However, it became quite apparent that there is a need for an information exchange map to visualize the current information exchange that is missing for now and then to work upon it for further improvements. This led to the creation of a sub goal:

***Sub goal**: Create a map to visualize the information flows in the current scenario.*

Method: The methodology used in this thesis is a combination of case study approach and design process method. The reason for the mix of two types of method is the nature of the study and goal of the thesis. Since case studies are focussed more on empirical analysis and design process methods are focussed more on the design elements of research, an equal mix of both were required to fulfil the objective of this thesis that requires a design solution in a practical setting. The thesis is planned in four stages ï Definition and Analysis, Design, Validation, and Recommendations.

Phase 1: Definition and Analysis: In-depth study explored the relationship between information flows and business processes, and the role of process integration emerged out. Process integration is about the integration of business processes by minimizing the effort associated with information flow between interdependent activities and leading to tightly coupled organizational activities (Berente, Vandenbosch, & Aubert, 2009). The four principle that leads to process integration are ï timeliness, accessibility, granularity, and transparency. These principles help to improve the information flows amongst the interdependent activities.

Accessibility is defined as the ñinformation readily available to activitiesò (Malone & Crowston, 1994). It can be further broken into three categories (Culnan, 1984) ï reliability, convenience, and ease of use. **Timeliness** comes from the coordination theory (Malone & Crowston, 1994), it implies a timely transfer of information from one point to the other, at the moment it is required. **Transparency** is related to the understandability of information. Information is understandable if the user finds it easy to use and understand with the same intent as it was meant to be (Berente, Vandenbosch, & Aubert, 2009). Further transparency is defined as a combination of understandability and consistency (Lee, Strong, Kahn, & Wang, 2002). **Granularity** implies the right level of detail required to understand the information by being concise and complete. (Volkoff, Strong, & Elmes, 2005). The four principles act as moderating factors that facilitate efficient information exchange in processes leading to process integration.



Theoretical Framework

Empirical Analysis: The four principles from the theoretical framework were used to analyse the issues that hinder information flows in the case company. The interviews and observation were structured (table below) such that all the four principles are explored invariably in the current project at the case company.

Major topics for interview based on the literature study

Principles of PI	***Related Interview Topics***
Accessibility	Ease of information exchange and understanding, Convenience level, and trustworthiness of the source.- in the current and the preferred scenario
Timeliness	On-time availability of information ï in current and preferred scenario
Transparency	Existing clarity on the process, level of clarity required and consistency of information ï the current and the preferred scenario
Granularity	Conciseness of information communicated (short and clear), required level of detail present in the information communicated (completeness) - current and preferred scenario

A stakeholder analysis was performed to understand the impact and influence of the stakeholders. It was found that the team members were not fully aware of all the developments in the project and have least influence and impact as compared with their managers. Delving deeper to find out the reason behind such a scenario, stakeholderôs relation with the team members was further explored via Stakeholder issue interrelationship diagram. It was found that there were many issues within the stakeholder groups. All the issues were listed and categorized.

To visualize the issues and information flows in the project, participatory discussions were conducted and an AS-IS map was developed to understand the current information exchange in the project. The analysis of the AS-IS map helped to point out major issues. It became apparent from the analysis that there are issues with *timeliness of information, redundancy of information, clarity on information exchange map and clarity on roles and responsibilities on which both the parties (SCW and Pune) can rely*. It was also pointed out that the departments had a local focus (case of local optimization) and not a holistic focus (system optimization).

Overall findings from interviews and observation

Categories	Occurrences (Interview)	Percent (Interview)	Occurrences (Observation)	Percent (Observation)	Total	Percent
Transparency	**23**	37	**12**	32	35	35
Need for clarification	3	5	2	5	5	5
Redundant communication	8	13	2	5	10	10
Difference in understanding	2	3	3	8	5	5
Unclear Information exchange	10	16	5	13	15	15
Granularity	**11**	18	**4**	11	15	15
Incomplete information	6	10	3	8	9	9
Unspecific communication	5	8	1	3	6	6
Accessibility	**23**	37	**16**	42	39	39
Checking for correctness	4	6	2	5	6	6
Finding right information source	4	6	3	8	7	7
Documenting work redundantly	5	8	3	8	8	8
Undefined roles and responsibilities	6	10	5	13	11	11
Transferring of information from one department to another	4	6	3	8	7	7
Timeliness	**5**	8	**6**	16	11	11
Waiting for information	5	8	4	11	9	9
Waiting for personnel	NA	NA	2	5	2	2
Total	**62**	100	**38**	100	**100**	100

Phase 2: Design

The concept of standardization emerged from the conceptual design as an alternative solution to the design needs (Davenport & Brooks, 2004) (Volkoff et al., 2005) (Berente et al, 2009). The key business processes have to be identified and correlated with corresponding information flow (Gerrits, 2016). For defining roles and responsibilities, a concept of responsibility matrix was proposed (Gautier, 2010). The next two requirements will be fulfilled by setting up rules and structuring project meeting for efficient information exchange (Demiris, Washington, Oliver, & Wittenberg-Lyles, 2008).

Final Design

Information exchange map:

The final information exchange map displays the pulling of information from different activities to the newly defined role of Customer Logistics in Pune. It establishes a centralized collection of information so that the customer logistics (who will also be the point of contact to SCW) is updated on all fronts and is capable of updating SCW at any moment. Previously, the information flow was sequential and the pulling of data happened verbally, that too with many layers of hierarchy involved. The new approach of centralized information collection bypasses the hierarchy layers, makes the information readily available, and facilitates informed and timely decision-making. The introduction of the program management team is another added feature. As of now, there is no fixed team and lacks representation from Pune. The new program management will be an official team of managers from Pune and SCW taking decision together, which was not done earlier. The team will perform a feasibility test, which includes the cost estimation, new tooling, machinery, and other resources that has to be decided before making any prior commitments with the customer.

Information Sharing Rules

Information sharing rules comprised on ï structuring project meetings and creating ground rules. It was decided to have three levels of separate meetings for information sharing ï managerial level meeting for status update and overview, cross facility meeting (Pune-SCW) for unresolved issues and update, and intra facility cross department (internal meetings including all involved departments) meeting for operational level update and discussion. The meeting rules or ground rules are:

- Use specific examples and agree on what important words mean.
- Explain reasoning and intent.
- Test assumptions and inferences.
- Jointly design next steps.
- Discuss undiscussable issues.

Phase 3: Design Validation

The design was validated based on based on four process integration principles presented in the framework. The results show that the teams in Pune and SCW have mutually agreed to the proposal of new team formation ï program management team and the centralized information control by customer logistics Pune. The information sharing rules and meeting structure has an organizational fit and fulfils all the requirements. There was an agreement on common information flow map for the future serial deliveries and it serves as standard guidelines to follow or to resolve conflicts regarding roles and responsibilities. Hence, all the functionalities related to timeliness, accessibility, and transparency were met.

Phase 4: Recommendations

Now that the information exchange map has been designed, and meeting structure and ground rules have been laid out, the question arises how these solutions can be used to achieve the desired results. A set of recommendations were made to address the managers of the project. These are:

1. **Switch on to use information exchange map designed for the project:** The information exchange map is designed collectively with all the key stakeholders. Sharing the map with all the key stakeholders will bring everyone on the same page and will lead towards a standardized process. The map should be used to clear out differences in understanding of information flows and roles/responsibilities.

2. **The implementation of meeting structure and information sharing rules will have a huge impact:** The current information sharing in the project meetings is not very structured. It is advised to collectively decide about the participants of each meetings and the meeting frequencies. Further the facilitator of meetings should make sure all the rules are followed properly. These rules will help to utilize the time and information shared more efficient.

3. **Importance of the implementation plan:** It is important to inform all the respective stakeholders about the information exchange map and meeting rules. It is necessary to explain the reason why the changes were made and what is in it for them. An implementation plan will help the stakeholders to soak up the information and save any unforeseen dilemma or ambiguity.

4. **Need for centralized information system:** It is recommended that the managerial team in the case company should work together to converge all the information at one place to make most of it. This can be achieved by building a ócontrol towerô (Aronsson & Huge Brodin, 2006) in future. It will reduce cost, reduce

environmental impact and increase delivery service (Aronsson & Huge Brodin, 2006). Currently, the case company has all the individual processes not linked to each other, so the next target should be to create a platform for the integration of all the individual processes. The information exchange map lays down the foundation to design the individual system by integrating the individual processes.

1

Introduction

ZF Friedrichshafen (ZF, here on) is a global leader in driveline and chassis technology. It is one of the largest automotive suppliers worldwide. ZF has several business units located at different locations that cater to different sectors of the automobile industry. This thesis works closely with a logistics department of the Damper division of Commercial Vehicle Chassis technology business unit of ZF Schweinfurt (SCW, here on).

1.1. Damper Division at ZF Schweinfurt

The damper division of Chassis Technology (TC) produces various types of dampers and its components. There were almost 3400 types of dampers produced in 2016, and delivered to 420 different customer location or sites, and it is similar in 2019 as well. Out of these 3400 different parts - 50% are high runners (high demand parts) which are produced in bulk while the other 50% are produced in small numbers which serve the niche market demands. TC division at ZF SCW counts in for almost 30% of the total sales of TC division in 2016 (ZF Schweinfurt Internal).

Figure 1.1 - Production locations worldwide for TC Division (ZF Schweinfurt, Internal)

TC division at ZF has production locations worldwide: Schweinfurt- Germany, Dielingen-Germany, Ermua-Spain, Izmir-Turkey, Gainesville-United States, El Salto-Mexico, Sorocaba-Brazil, San Francisco-Argentina, Shanghai-China, Shiyan-China, and Pune-India. Amongst all the locations, Pune-India is the best cost country (cheapest) for ZF.

Table 1.1 - Some relevant facts (all data from 2016, ZF Schweinfurt Internal)

Facts	Figures
Sales Commercial vehicle technology	3,387 Million Euros
Sales Chassis Technology division (all)	657 Million Euros
Sales SCW Chassis Technology division	198 Million Euros
Dampers produced per day in SCW	~25000 pieces (approximately)
Different types of dampers in SCW	3400
Number of Customers/ Sites	150/420

In 2007, ZF finally started with its first fully owned subsidiary, a multi-product facility based in Pune, India (ñZF in India,ò2019). Until now, the facilities in India catered to the customers located only in the Indian subcontinent. The management of the company has recently decided to move the production and assembly of the high running dampers to ZF Pune, as India is the best cost location for the company.

1.1.1. Decision to Move Production

The decision to produce parts from India can be analysed from the perspective of transaction cost theory (Williamson, 1985) & (Williamson, 1981). The logic of transaction cost analysis pushes firms towards a high level of control over resources and the concentration of these resources on specific process components, while they have a strong tendency to outsource, use service providers, etc. for other components and vice versa. Firms often involve different suppliers, service providers, offshore or outsource different activities to leverage the comparative advantage of different geographic locations and resources with their competencies to maximize their competitive advantage (Mudambi & Venzin, 2010). This was the reason for ZF as well to move the production to India. The transaction cost can be referred to as the cost incurred to coordinate people and machines to perform a process (Williamson, 1985) & (Williamson, 1981). To increase profitability, the costs incurred by the company needs to be minimum. The transaction cost can be minimized by coordinating effectively and efficiently between the resources. Hence, firms need to minimize the coordination cost, thus increasing operational efficiencies to make the disaggregation of value chain successful (Ganesan et al., 2009).

1.2. Project P2S at ZF SCW

ZF SCW has a standardized process called customer-to-customer process diagram which depicts the end-to-end customer journey within the company. The process helps to identify interdependent departments, right from the order received until the delivery of goods to the customer. This process, figure 1.2, is also an input for this thesis (ZF Schweinfurt Internal).

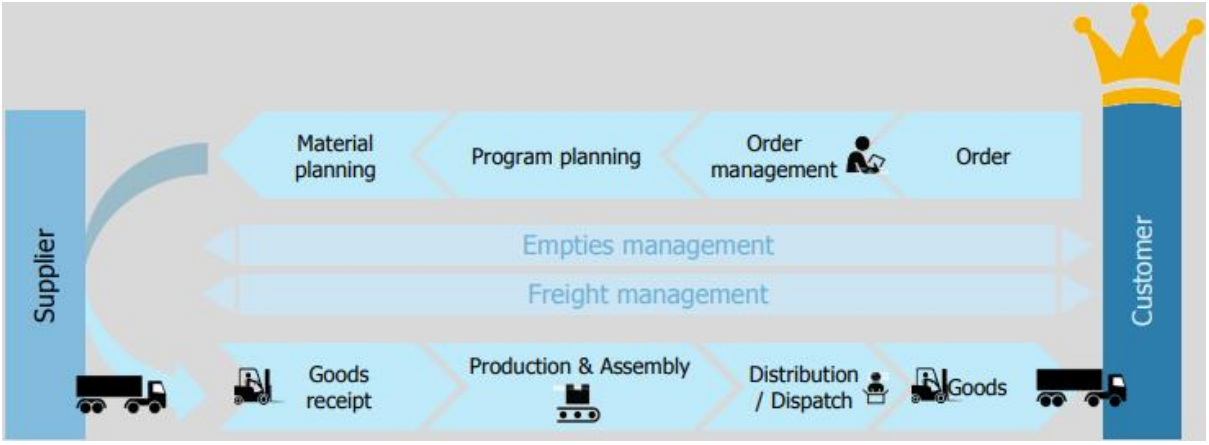


Figure 1.2 – Customer to customer process (ZF Schweinfurt Internal)

The interdependent departments represented in figure 1.2 are used for the in house production of dampers at SCW. The activities related to the departments shown in figure 1.2 are not documented. For the project Pune to SCW (P2S), there is currently no customer-to-customer map available. However, the logistics department has a schematic diagram called planned delivery concept that shows the material, information and financial flows to be involved between the parties, figure 1.3. The figure can be explained as - ZF Schweinfurt (SCW) receives orders from the European Customers, and then ZF SCW forwards the order to ZF Pune. ZF Pune will deliver final products to the warehouse in Europe maintained by a service provider via sea freight (service provider). The final products will be delivered to customers from the warehouse based on the delivery request from SCW (ZF Schweinfurt Internal).

Few important characteristics of this project P2S are-

- The ERP system used in ZF Pune (Navision) is different from ZF SCW (SAP).
- ZF SCW summarises an order from the client and will give to ZF Pune via Electronic data interface (EDI). (Currently teams are working on EDI connection and soon the connection be up and running.)
- The whole process in Pune - Production, assembly, supplier contact, etc. is estimated to be 4 weeks in ZF Pune.
- Eighty part numbers will be produced in Pune that counts almost 50% of overall sales quantity of ZF Schweinfurt.
- A local service provider performs painting externally. Parts are sent for painting and then brought back to ZF Pune for final assembly.

- The shipping time from Pune to Warehouse in Germany (location not fixed) is about 6 ï 8 weeks.
- Warehouse (maintained by a service provider) would receive the goods from sea Freight Company ï carries out logistical bookings ï quality checks ï repackage ï deliver to the customer based on first in first out principle (FIFO). Maximum time allowed between acceptance of good and collection is 4hours (ZF Schweinfurt Internal).

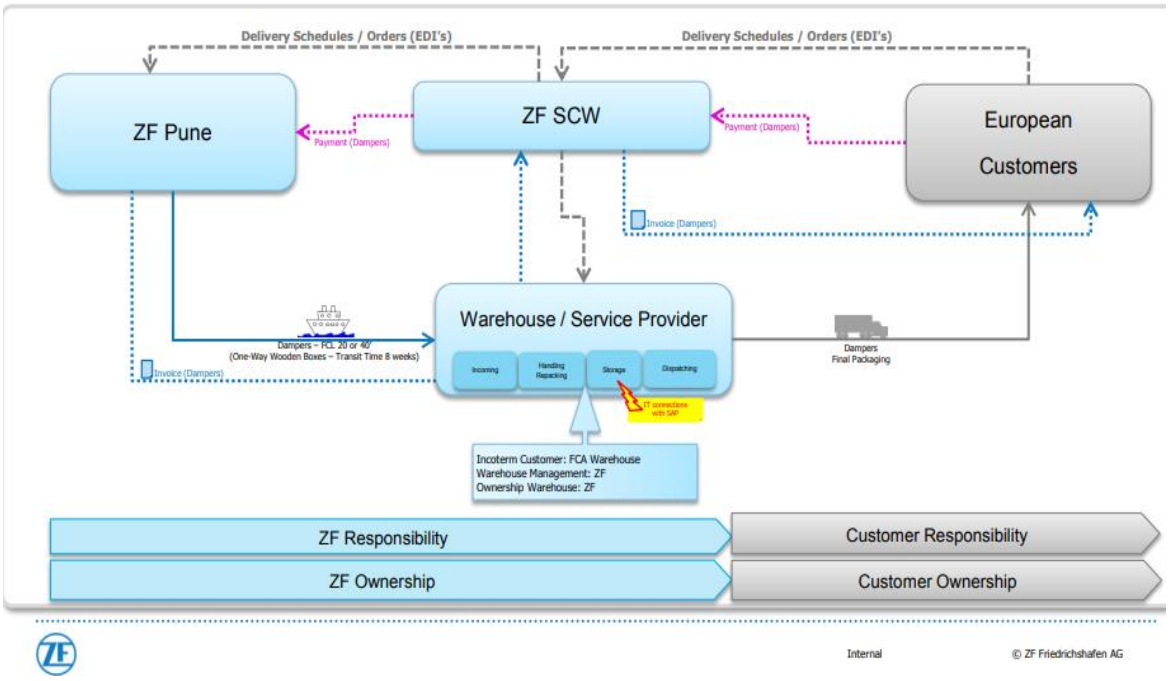


Figure 1.3 – Supply Chain Delivery Footprint (ZF Schweinfurt Internal)

(Self) Analysing the Current Scenario

Based on the information available for the project P2S, few observations were made during a self-analysis. To start with, there is no customer-to-customer process map available for project P2S. Since the project involve two different teams Pune and SCW who have different processes, teams may not be sure about the each others processes. Secondly, it is mentioned that there is no EDI connection at present, so currently all the order details are sent from SCW to Pune over emails and via project meetings. Thirdly, it can be observed from figure 1.3 that there are no material flows from SCW but at the same time all the information routes back to them. It makes them very dependent on the information exchange from Pune and the service providers. Lastly, the time from when orders are requested to Pune until it is delivered to the warehouse is approximately three months. This means that SCW has to consider this lead-time before placing an order in Pune. However, in case of a delay, SCW will have to produce internally or use safety stocks to meet the customer demand if the information exchange takes place timely. It is important to note that, if they are not

notified about the delay at the right time, the company can suffer huge losses in terms of reputation or sales.

1.3. Challenges in Project P2S

With the strategic move of producing dampers in Pune, delivering to clients in Europe and managing supply chain operations across the two continents is quite new and the damper division is doing it for the first time. The demand for the customers is expected to be met in the same way as it was handled before without losing customer satisfaction or drop in sales.

From the preliminary interviews with the managers in Project P2S, few challenges were pointed out that are mentioned hereafter. Project P2S involves a variety of stakeholders and a lot of information exchange takes place across teams in Pune and SCW. Currently, there is no clear visibility in the project ï as the team members from SCW and Pune are not sure about their roles and responsibilities. Also, there is no customer-to-customer map for the project which can be used to understand the information flow, this make processes opaque and creates a lot of speculation. The managers and team members faces a lot redundancy in information because of the speculation. It results into high transaction costs and low coordination for the project. All of this makes it quite hard for the managers to make coordination between teams smooth. It is apparent from the fact that there has been a significant delay in the start of production due to unclear information flows between the stakeholders. As stated by the logistics manager SCW ï

ñ*We need to work on the information flows first and the material flows will follow."*

1.4. Effects of Information Exchange in SCM

The main objective of supply chain management (SCM) is information sharing and coordination amongst the entities in the supply chain. Both of these aspects can help to reduce transaction costs as well as logistics cost (Pagh, Lambert, & Cooper, 1997). Studies have shown that the information exchange between firms with service providers have positively affected logistics performance and responsiveness (Daugherty, Ellinger, & Stank, 1996).

The main approach to a smooth supply chain is to make sure that the information is intact and available at every node within the supply chain. By using readily available information, firms can quickly act to customer demands or changing needs. Effective information exchange can lead to advantages to the firm in the long run. Information exchange increases the coordination between the processes and enable material flows. It can result in reduced inventory levels and increased partnerships between the

supply chain partners. However, the information has to be reliable, mutually understood, transparent to gain trust between partners in the supply chain. Information has limited value if there is a delay in information transfer and not readily accessible (which often happens when teams are not collocated). As a result, it often leads to a mismatch between demands and supply (Rai, Patnayakuni, & Seth, 2006). This lack of information sharing leads to operational inefficiency, high coordination and transaction costs. In the current scenario at ZF, there is no clarity on how information exchange is taking place since the project is new, not everyone is aware of who has to be contacted to receive the desired information. This leads to high coordination costs that affect the performance of the firm.

Needless to mention, the positive effects of clear transparent information exchange reduces the additional workload that employees often face. A higher level of information sharing lowers the overall cost, higher fulfilment rate and shorter lead times (Lin et.al, 2001). However, the impact of information exchange depends upon what needs to convey, when the information is required, how it has to be shared and with whom the information has to be shared (Chizzo, 1998). Hence to facilitate the information sharing across the partners in the supply chain, it is required to understand the factors influencing information flows between the processes to overcome the barriers of information exchange and foster smooth information exchange across all the parties in a supply chain (Li and Lin, 2006).

1.5. Problem Statement

The challenges presented in section 1.3 and 1.4 brings out an important aspect of coordination i.e. information exchange amongst supply chain partners. As pointed out from the literature, information exchange across teams is effective when there is clarity on the information between the stakeholders. This is the current gap in the project P2S of the case company. It was mentioned during the preliminary interviews that it is not clear who does what and not all the stakeholders are aware of all the project proceedings. There is a need for a visualization in the form of information exchange map where stakeholders can understand the information flows and associated processes. However, it is very important to first develop a map depicting information exchange in the current situation and then work on it to improve the information flows. Hence, the design objective is formulated as:

Design objective/goal: *"To design an information exchange map using a business process model to improve information flows between the processes in the customer to customer process for the logistics departments of the case company."*

***Sub goal**: Create a map to visualize the information flows in the current scenario.*

1.6. Thesis Structure

The following figure 1.4 gives an overview of the structure of the thesis. The thesis structure complements the methodology discussed in Chapter 2. This thesis can be categorized into four phases ï analysis and definition (1), design phase (2), Validation (3) and Recommendation (4), see figure 2.2. The phase one consists of two chapters - chapter three and four. Chapter 3 is about literature review and other related information. Chapter 4 reports empirical analysis of interview and observation facilitated by the case company. The result of the analysis will provide insight to develop a map to visualize the existing situation. The existing map created will be analysed to find major issues and needs. Chapter 5 will present the design specification developed from chapter 3 and 4. In Chapter 6, will present the conceptual design based on the state of the art methods and tools available in the literature. After having the conceptual design, participatory design sessions will be held to collectively work with the stakeholders to improve the current scenario map by addressing the issues determined during analysis and definition phase. The design phase is an iterative process where constant feedbacks are taken from the stakeholders to improve the design iteratively. The final information map is validated with the help of participatory design discussion consisting of an expert panel in Chapter 7. In chapter 8, the thesis in concluded together with the discussion of results and its limitations. The objective of the thesis is justified with the final design proposed.

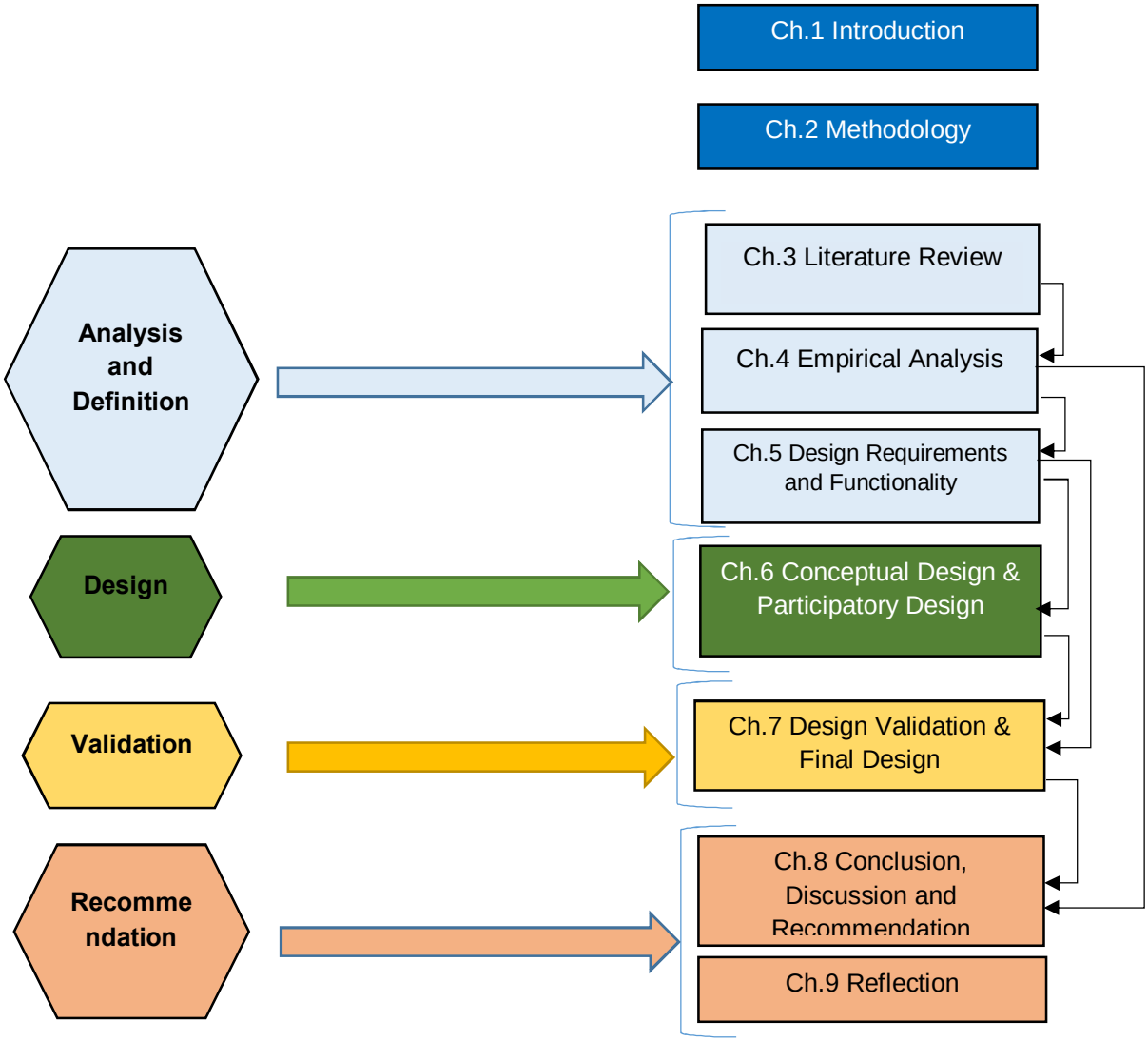


Figure 1.4 – Thesis Structure

2

Methodology

2.1. Methodology - Case Study and Design Process

This thesis is in collaboration with ZF that serves as a case study company. It facilitate resources (data collection, user participation, and validation) to study problems and issues in project P2S of the company. The case study is conducted together with an embedded design process method to solve the problem statement that was formed from the case study (Chapter 1). The case study method emphasises the study to be done in a real-world setting, which is very resonant with the research intention on the objective. There is a need for in depth qualitative studies in an industrial setting to find out the information flows and associated processes, responsible stakeholders to understand the information exchange. A case study provides a platform to gather data via interviews/ observation, design together with the users and evaluate the practicality of the solution in an industry setting. A case study method has usually the following steps (Yin, 2004) ï

- Design the case study
  - Determine requirements
  - Develop and review protocol
- Conduct case study
  - Prepare data collection
  - Distribute questionnaire
  - Conduct interviews
- Analyse case study evidence
- Develop conclusions and recommendations

However, this thesis cannot follow a typical case study approach. It is because the problem statement from the case study point towards a design objective for this thesis and case study method does not provide a clear approach to design. A design framework presented by ôDym and Little (2009)ôï design process method has been chosen as it complements the case study and helps to reach the objectives laid during the process. Figure 2.1 presents a five step of the design process from Dym, Little,

Orwin and Spjut, 2009. However, the design process method is too specific for this case study and not all the elements are required. Hence, the mixture of the two methods mentioned above is used as a method to approach this thesis. Table 2.1 elaborates how different steps of case study and design process contributes to the steps adopted in the methodology of this thesis.

Figure 2.1 – Design Process Method (Dym, Little, Orwin, & Spjut, 2009)

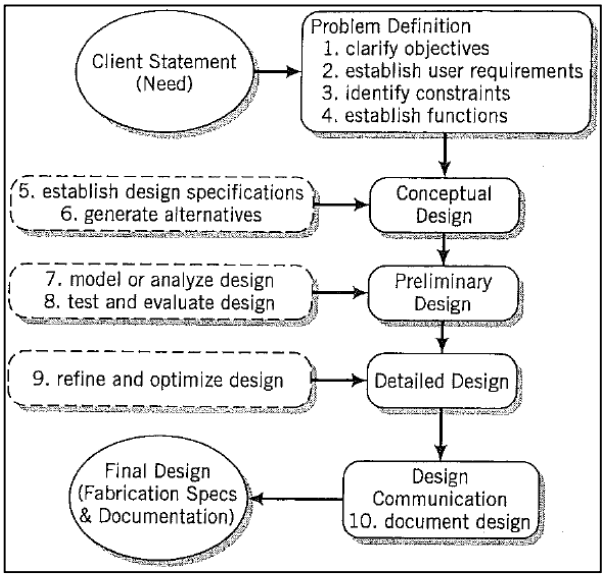


Table 2.1 – Correlation between design method and case study

Case Study	Design Process	Thesis Method	Reason for the choice of Method
Design the case study Conduct case study	Problems Definition	Analysis and Definition	In this section, the problem statement is analysed and defined in the light of literature and empirical analysis of the case study. It helps to pin point the areas of improvement or requirement for further design.
Analyse case study evidence	Conceptual Design Preliminary Design	Design	Design stage focuses on conceptual design and modelling of design together with the stakeholders from the case company. A participatory design approach is involved to discuss solutions based on the case study evidence.
	Detailed Design	Validation	Validation of the design needs to do together with stakeholders from the case company based on the case study evidence. A final design will be presented after the validation.
Develop conclusions and recommendations	Design Communication	Recommendations	Recommendations are drawn from the combination of conclusions drawn from the case study and guidelines for the stakeholders to use the design (in the form of implementation plan).

A final method adopted for this thesis is presented in figure 2.2.

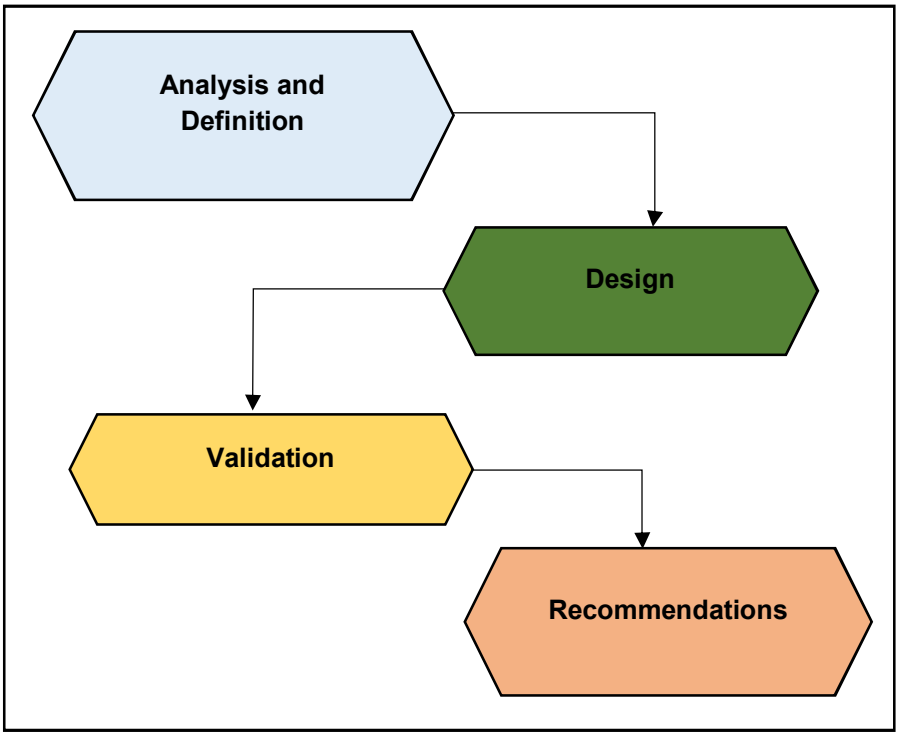


Figure 2.2 – Method adopted for thesis

2.2. Methodology used for Analysis and Definition

The analysis and definition phase consists of a literature review, questionnaires, stakeholder analysis and triangulation of the data collected from interviews and observations.

2.2.1. Literature Review (Chapter 3 Part 1)

The theoretical foundations for the design requirements have to be accomplished by a literature review. This method helps to understand the different frameworks, state of the art literature and technologies across the literature. The method helped in understanding key concepts and learning important factors to support further research and design.

The relevant concepts are being studied in depth to explore all dimensions and then important findings will be used to formulate a framework or guidelines to help the further design process. After the development of a framework, further research will be done to understand the state of the art technologies and tools to generate more ideas. The study performed during this stage serves to be the foundation for the whole thesis.

2.2.2. Interviews (Chapter 3 Part 2)

Interview is one of the data collection methods used in this thesis. Interview protocols and guidelines are to be followed for the interview. E.g., interviews should not exceed more than two hours, direct observation in a field setting within an organization should be accompanied by taking notes, usage of audio tapes and using category specified instruments for uninterrupted recording of open-ended interviews. The interviews for this thesis will be conducted per department until there is a saturation in data received, meaning no new data is received further. During the start, the interviews will be conducted in an unstructured way to explore the broader problem area. Later semi structured interviews are being conducted to gain more information related to a specific area. Questionnaires are made to structure the interview as per the stakeholders.

2.2.3. Delphi Technique (Chapter 3)

A group of people is chosen to conduct a discussion. In the first round, the experts will be asked to answer questions based on the current scenario. The responses are then collected, summarized and fed back to form a new design. In the second round, the next group of experts will be provided with the updated design and questions will be asked based on a current scenario considering the opinion of other experts into account. The process goes on until it leads to a consensus on a final design. The reason for this method is that no stakeholder gets to know each other and hence the power distance, hesitation and other factors never come into play which is a win-win situation for everyone (Sekaran & Bougie, 2016). This technique will help to develop an information exchange map of the current scenario ï sub goal of the thesis.

2.2.4. Stakeholder Analysis (Chapter 4)

Stakeholder refers to an individual, group or organization who are or can be affected by an output or a process or a resource (Bryson, 2004). Stakeholder analysis is often used while planning an activity, which shows the interests and concerns, related to the stakeholders. Stakeholder analysis is a range of techniques or tools to identify the requirements, interests of stakeholders. The analysis often helps to understand the underlying problem or pressing issue. Since there are many stakeholders associated with the customer-to-customer process, an analysis reflecting stakeholderôs position and their related issues will provide many insights and will help to pin point the gaps in the project.

Influence and Importance diagram: Influence implies the stakeholderôs relative power in the project. A stakeholder having a high influence is capable of taking decisions and controlling activities or influence others to take due action. Importance, on the other hand, is the level of significance of the stakeholder, which affects the

goals, and purpose of the overall project (Smith, 2000). The stakeholder influence and importance diagram show the overall position of the stakeholders overall position in a project. It highlights which stakeholders interest should be taken into account to address the problem (Bryson, 2004).

2.2.5. Participatory Observation (Chapter 4)

Observation can be of different types but for this thesis, participant observation is chosen. The reason for the selection is that the information exchange between the different stakeholders is high and since the project is in a developing stage not all of the communication is structured or documented. Hence, there is an obvious need to indulge in the project proceedings to have a closer look. It can involve participation in team meetings that will enable closer observation of actual scenarios with detailed information. However, it should not be intrusive to the companyôs proceeding (further during the chapters protocols will be discussed) (Spradley, 1980).

There are few limitations as well to this method. It can be noted that the observer who serves as a medium to collect data, being a human, could be susceptible to biases. Besides, the theoretical approach pursued, ethnicity, gender and class may affect the observation (Kawulich, 2005). Additionally, after the observer mentions its role during an observation, the proceedings may not be very real as participants who try to portray things nicely to make the proceedings look good. It is also called a Hawthorne effect (Sekaran & Bougie, 2016). However, to mitigate these limitations, certain measures have been taken. First of all good field notes is important. It includes use exact quotes as much as possible, describes activities in order, being unobtrusive and include relevant background information (Schensul, Schensul, & LeCompte, 1999). Usually there are two types of observation carried out ï descriptive and selective. During the descriptive observation, there was an open discussion about everything going around in the company. Information was gathered pertaining to the history and background information of the project. The focus of observation was on the actions, feelings, and emerging topics related to the project. During the second stage (selective observation), the focus was on participating in different events related to the project and looking for similarities, patterns or exceptions amongst the events. It on was done together with the interviews of the project stakeholders.

2.2.6. Data Triangulation (Chapter 4)

The data collected from the case company should be triangulated using a broad array of techniques; it cannot be based just on the interviews or site visit. The more the source of data sources concurring the same data the stronger the evidence (Yin, 2004). Appendix 1.3 contains the framework for strength and weakness for the selected sources of evidence Yin (1994). The methods used to collect data in this

thesis were interviews and observations together with the company documents. There is a need to check and recheck constantly for the consistency in data derived from different sources such as interview, archive documents, etc. The most desired condition will be if three or more independent sources converge to the same point (Yin, 2014). Hence, proper data triangulation would be a method to check for the consistency of data collected from different sources.

2.3. Methodology used for Design

The Design phase consists of methods like benchmarking, participatory design discussions and Delphi technique.

2.3.1. Benchmarking (Chapter 6)

Based on the design requirements, benchmarking was performed to find industry best practices, state of the art methods and techniques to generate ideas for conceptual design. The focus was on to learn improved practices, processes or knowledge in the industry (Camp & Camp Robert, 1989). It includes desk research done to find business process modelling notation, RACI matrixes, etc. and which were used later on in this thesis.

2.3.2. Participatory Design Discussions (Chapter 6)

It is a type of design that is done by the people, not on the people (ñWhat is Participatory Design?,ò2019). It involves the active participation of the stakeholders in research or design by a process of sequential reflection and action. It facilitates the observation of the behaviour of participants during a process. The choice of this method is due to the reason that this type research explores the challenges and dilemmas of participatory practice which cannot be observed or understood other than this method (Cornwall & Jewkes, 1995). Collective stakeholder discussion sessions facilitated the participatory design for this thesis.

A collective stakeholder discussion is planned in the form of participatory design for this thesis. The discussions will help to generate an AS-IS Map, streamline and validate the design. The first round of discussion will be based on the Delphi Technique in form of one on one interaction with the team members to understand the overall current information flows within the processes. Since the discussion is one on one there it gives the stakeholder more time to express, no hesitation or power distance[4] never come into play (Sekaran & Bougie, 2016).

The second round includes the consolidation of all sub processes to develop a clear picture and ideation about required future state. The discussion will be one to one with managers. The managers are in charge of this project P2S, their experience and strategic management alignment, helps to guide the development of future design, and at the same time validate the information flows. Finally, the last round of

discussion with functional managers together with logistics managers will be conducted to validate the design generated from round two. An expert panel will be invited to review the design, potential issues and provide suggestions. This will help to facilitate the meeting and drive consensus.

2.4. Methodology used for Validation

2.4.1. Expert Panel (Chapter 7)

To validate the design by detailing to the implementation level, an expert panel was used. ñIt is a group of people from specifically convened by the researcher to elicit expert knowledge and opinion about a certain issueò (Sekaran & Bougie, 2016). The expert panel consists of functional managers together with important stakeholders of the project to discuss the final design. In comparison to interviews, expert panel significantly takes less time. In comparison to questionnaires, the response rate is much higher. Since the number of participants is quite less, the discussion can be much more constructive and noteworthy (Sekaran & Bougie, 2016). The evaluation of the design should match the criteria or parameters set out during the analysis and definition phase.

2.5. Methodology used for Recommendations

Recommendations will be presented based on the results of the literature review, feedbacks observed during interviews. The knowledge gained throughout the thesis together with known limitations will be considered in formulating the recommendations. The recommendation will include the implementation plan of the design discussed together with key stakeholders.

Table 2.2: Summary of the methodology used in the thesis

Stages	Methodology
Gather user requirements, identify constraints and establish functions to refine the objective of the design. (Analysis and Definition)	Literature Review, Interviews, observations, Stakeholder Analysis, Case study approach, Data Triangulation
Generate conceptual design(s) and participatory design. (Design)	Benchmarking, Case Study, Participatory Design, Delphi Technique
Refine design, test and evaluate (Design Validation)	Case Study, Participatory Design, Expert Panel
Determine the value and impact of the design. (Conclusion, Recommendation and Discussion)	Results from all of the above

2.6. Deliverables

The deliverable expected at the end of this project will be a design, which should be able to meet the following functionalities.

1. The design depicts all processes in the end-to-end customer process and provides a bigger picture to all the stakeholders involved.
2. It provides clarity on ówho is responsible for what for all the processes involved in an end-to-end customer process.
3. The design should propose recommendations to strengthen the information flow in the current process.

2.7. Thesis Flow Diagram

The thesis flow diagram figure 2.3 shows the key elements of the thesis and the methods to achieve them. The first important checkpoint will be to determine a theoretical framework from the literature and the available inputs. Thereafter, based on the empirical analysis (interviews, observations and participatory design discussions) an AS-IS Map is created to depict the information exchange between the processes in the current situation. This map will be analysed further to pin point the areas that need change or have to be addressed in the design. The new design will be an updated map that includes all the design requirements set out earlier. Finally, recommendations will be made as per the final design.

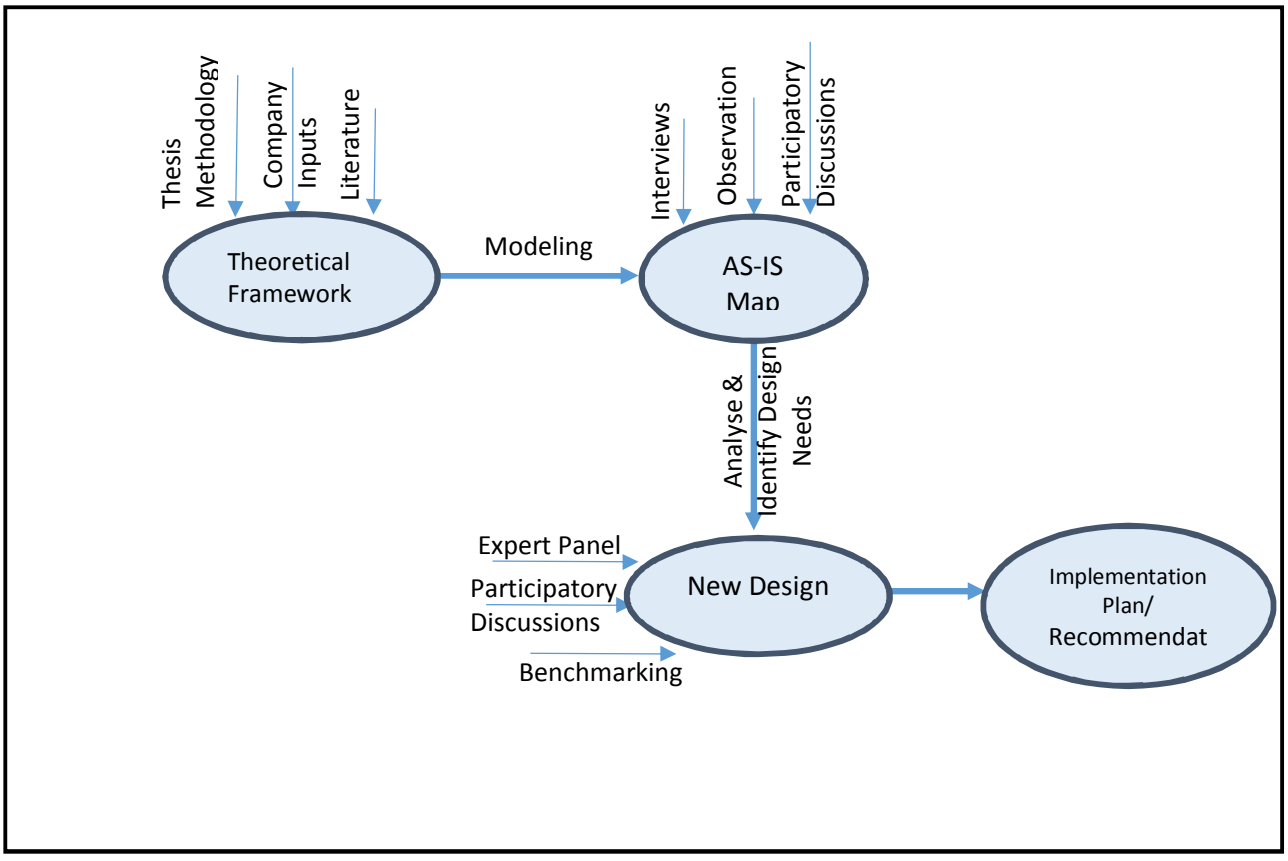


Figure 2.3 - Thesis Flow Diagram

3

Analysis and Definition

There are two major terms used in introduction chapter ï business processes (referred as processes) and information flows. It is important to define these terms and then explore them further. In this chapter, all the key terms used in this thesis will be defined and analyzed. This chapter aims to create a theoretical base in form of a framework by the help of scientific literature to be used for the rest of the thesis

3.1. Business Processes and Information Flows

Business Processes: Business Process are defined as an organizational form that captures the interdependence of activities, task, roles, departments and functions required to accomplish a product or a service (Earl, 1994). They are the set of formal procedures made by the organizations suiting their objectives (Ray, Barney, & Muhanna, 2004). The firmôs overall performances depend upon the net result provided by the business processes. Once a high-level process is in place and has been recognized, all sub processes fall in line to make it complete. ñThus, teamwork, especially across the boundaries, is incorporatedò(Earl, 1994). Above all, the inclusion of all the activities together helps and promotes the notion the system optimization from the local optimization. However, often organizations ignore or forget the documentation aspect of the processes. Additionally, often there is a need to include an empirical observation and analysis to identify key stakeholders. Once all stakeholders are identified, processes can be documented with the use of business process modelling, design and analysis tools (Earl, 1994).

Information Flows: Information flows represent the information exchange/knowledge exchange between partners. This results in an access to information of a partnerôs complementary strategic resources. The information flows can be classified into three categories ï order, operational, strategic and strategic/competitive. Order information flows are the information exchange in routine transactions, while the other three are considered as the strategic level of information exchange, as it helps decision-making. Operational information is related to production related information about resources and conditions. The strategic category focuses on financial or revenue related information and strategic/competitive information relates to marketing related

information used for competitive positioning (Klein & Rai, 2009). In the context of this thesis, information sharing is mostly related to the first two categories ï order and operational. Information flows can also be related as a form of communication in an organizational setting. Communication has been substituted over the year and now the traditional forms of communication i.e. face to face and an electronic or computerized form of communication has replaced telephone calls.

The exchange of material and information takes place during the inbound and outbound processes in the supply chain (Lambert, Pagh, & Cooper, 1998). Usually, a hierarchical structure is present in a traditional good producer setting in which raw materials flow into the supply chain, after processing by producer, final goods flow out of the supply chain to the customer via a distributor (Swaminathan, Smith, & Sadeh, 1998). This improves coordination but does not optimize the information flow, response time and time that is required in todayôs era. Improving the information flow can reduce the number of transactions associated with the movement of the goods (Lewis & Talalayevsky, 2004).

Relationship: Activities in a process usually takes an input, adds value to it and delivers out an output (Berente et al., 2009). ñThis input and output represents the flows between activities and are typically comprised of informationò (Kock, McQueen, & Corner, 1997). A study was conducted including 22 business processes and it was found out that 90% of flows related to processes were information flows (Kock et al., 1997) (Berente et al., 2009). This makes business processes and information flows complementary to each other. Information flows can be seen as a binding element which binds all activities together to define a process. However, it is quite usual that the processes are spread across individuals and locations to leverage company specific goal, as in the case study, and needs coordination between interdependent activities (Berente et al., 2009). Distributed work requires information flows between activities and personnel within the process to coordinate with each other (Malone & Crowston, 1994). There are three reasons for it ï a huge amount of information sharing is required between interdependencies, interdependencies require collaborative problem solving with people from other units/departments and they all need to have trust to facilitate the former two reasons (Brown & Sambamurthy, 1998). Interdependent activities share different types of dependencies among themselves such as transferability of work, timely transfer of activities etc. based on the overall objective of processes. E.g. some processes aim to manage shared resources, or have producer/consumer relationship where one output is input for the other, or managing simultaneity constraint where activities are have to occur at the same or and managing task/subtask relationship (Malone & Crowston, 1994).

However, the theme of this thesis relates to the producer consumer relationship in which one activity produces something which is consumed by the other and it is quite common in manufacturing processes.

Table 3.1 – Dependencies as per coordination theory adapted (Malone & Crowston, 1994)

Dependency (Producer/consumer relationship)	What is means?
Transfer	Timely transfer of activities and communication of required level of information
Usability	Understandability of information and ease of access

Table 3.1 shows examples of coordination for a producer-consumer relationship. The key dependencies in the context of information flows are ï transferability (the primary activity has to transfer to secondary activity- transfer of physical products or information) and usability or interchangeability of the primary components produced. A primary activity can be transferred by either communicating (if a primary activity is an information) or by transporting it. Usability relates to the understandability of information transferred and the ease of use with which it can be accessed (Berente et al., 2009). However, it is often that the activities in different processes are not able to communicate easily. It is because of the reason; the practices used by the owner of different activities are not consistent with each other. Therefore, there is a need for process integration.

Keywords Used for Literature review in Google Scholar, Duck Duck Go, TU Delft Repository and SCOPUS
1. Information flows/ exchange AND Business Processes OR Supply Chain 2. Coordination AND Information exchange/ flows AND Supply Chain 3. Process Integration OR Business Process Integration AND Information exchange/flows

3.2. Process Integration

Process integration is a fundamental effort to improve the business processes. The key focus on the integration is due to the desired optimization in activities or planning logistics activities (Sabath, 1995). However, the term process integration has not been explicitly defined in the literature. For an instance, it is often referred as an act of process improvement, or it is a collaboration between two or more organizational process, or it is a method to achieve interdependent activities to work together (Malone and Crowston, 1994). While there is clear segregation from the other integration activities such as data integration or system integration (Berente, Vandenbosch, & Aubert, 2009).

In this thesis, the process integration is defined as an integration of business processes that involve minimization of effort for associated information flows between the interdependent activities and similar practices that lead to a tightly coupled organization (Berente, Vandenbosch, & Aubert, 2009). The major advantage of process

integration can be seen in the context of transaction cost theory. The efficient and effective information exchange between processes leads to reduces cycle time, enhances flexibility and eliminates non-value added activities like clarification, follows up or repetitive information, which increases transaction costs. There are four principles of process integration that is defined in the literature (Berente, Vandenbosch, & Aubert, 2009). These principles help to improve information flows between the processes by focussing on improving timeliness, accessibility granularity and transparency and are derived from dependencies listed (see table 3.1) in coordination theory (Malone & Crowston, 1994).

1. Accessibility
2. Timeliness
3. Transparency
4. Granularity

3.2.1. Accessibility

Accessibility is defined as the ñinformation readily available to activitiesò (Malone & Crowston, 1994). The information should be accessible to the required activity within a process (Berente et al., 2009). Literature defines accessibility into three categories (Culnan, 1984) ï reliability, convenience and ease of use. The dimension of reliability implied that the information flow should be certain, dependable, failure free and reliable. The actors involved in the processes often involves are careful about the information they receive as any non-reliable information could lead to a big impact on the business. Convenience is defined as easiness of information access in comparison to other methods. Lastly, ease of use is related to easy to use, flexible, forgiving, and friendly usage of information available (Culnan, 1984).

3.2.2. Timeliness

The principles of timeliness come from transferability dependency of coordination theory. As defined by (Malone & Crowston, 1994) transferability is one of the major factors for coordination as it implies a timely transfer of information from one point to the other. Timeliness is an important part of process integration as the timely transfer of information across activities needs to instantaneous. Instantaneity does not mean instantly processing information and sending it right away. It means that information should be received to the required activity right at the moment it is required without a delay. It is important to know that if an activity can start earlier if information can be provided earlier. (Berente et al., 2009).

3.2.3 Transparency

If the information is received timely and can be accessed, it does not mean that the information received is correct or accurate and on top of that it has to make sense i.e. understandability of the information. Often different groups require a different level of information detail. Similarly, a different set of people can infer different understanding from the same information (Volkoff et al., 2005). The ôusabilityô dependency defined in the coordination theory (Malone & Crowston, 1994) can be explained as, the interchangeability of parts, that should always produce the same result as a recipe.

Transparency is related to the understandability and consistency of information (Lee et al., 2002). Information is understandable if the user finds it easy to use and understand with the same intent as it was meant to be (Berente et al., 2009). While consistency implies that the information has to be coherent and logical throughout (Cykana et al., 1996). Therefore, information is transparent when it is understandable and consistent throughout the receiver.

3.2.4. Granularity

Another important principle is the granularity of the information. It implies that the right level of detail has to be provided during information exchange. The level of details required varies for different users and activities. If all the processes and users receive the same level of information, it often creates conflicts amongst users and leads to additional work to further decompose or summarize a piece of information. To sum up the information is over informative or under informative which leads to a problem of understanding (Volkoff et al., 2005). Thus, the information needs to concise/specific and complete. If these conditions (conciseness and completeness) are met for information, the extra efforts to clarify information can be avoided, hence lowering the transaction cost for coordination.

Keywords Used for Literature review in Google Scholar, Duck Duck Go, TU Delft Repository and SCOPUS
1. Process Integration OR Business Process Integration AND Information exchange/flows 2. Accessibility OR Timeliness OR Transparency OR Granularity AND Information exchange/flows AND Supply Chain

3.3. Proposed Framework

It has been established deductively in the literature review that four process integration principles help to integrate information flows within a process of a company. The four principles act as moderating factors that help to tailor the information flows as per the requirements of a project and leads towards a tightly coupled project with higher coordination and low transaction costs. Figure 3.1 depicts that information flows leads to process integration with the help of the four principles where process integration is

positively affected by information flows in the presence of four process integration principles. Figure 3.1 is used as a framework for empirical analysis in the next chapter.

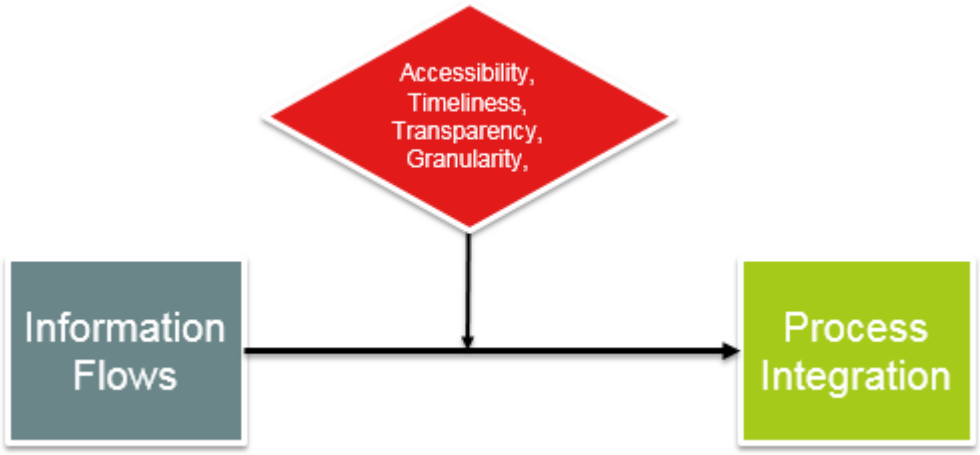


Figure 3.1 – Relationship between information flows, process integration principles and process integration (Sekaran & Bougie, 2016)

3.4. Conclusion

The literature review of information flows and business process has reflected the relationship between them and the importance of process integration. Further, four principles were defined for process integration based on the dependencies of coordination theory ï transferability and usability (Malone & Crowston, 1994). The principles serves as moderating factors to improve the information flows in processes. The proposed framework shows the representation of the literature finding which needs to be validated by empirical analysis done by interviews and observation in the next chapter.

4

Empirical Analysis

4.1. Context of the Case Company

To find the underpinning issues that hinder information flows in the case company. It was important to understand the different factors existing in the practice with the help of process integration principles. Also, it was important to know what are the standards or rules used in the organization at present, or what are the constraints or resources available. This section of the thesis is to understand the concerns, needs, organizational contexts of the case company and then compare it with the finding from the literature. The comparison helps to develop inputs for further design requirements.

From the last chapter, figure 3.1 presented the framework developed based on literature review. Based on this framework, information flows in the project P2S of the case organization was accessed. The presented principles were ï accessibility, timeliness, transparency, and granularity were checked to determine the current scenario.

4.2. Interview Design

For designing interviews, it is important to identify the main elements to structure an interviews so that the interviewees feedback and inputs are understood and is relevant for the design process to be carried out. In this case the main elements to structure will be based on process integration principles. The understanding from these principles leads to the development of the interview questions and helps to develop an interview protocol to guide the overall interview.

4.2.1. Interviewees

The detail introduction of interviewees and their details are already mentioned in section 2.4.2 of Appendix 2. All the stakeholder departments have a department manager or a project leader together with the employees belonging to two categories:

New joiners or less experienced employees, and experienced employees or functional experts. A condition was established to interview employees who were with the start of the project (the project started in 2015) with the company i.e. the functional experts. It was because of the reason that the interviewees have all the details and are fully aware of all the information. This provides them with sufficient instances to share and compare while narrating their answers. An exception was made that if the employee had a very crucial position in the project. For the external service providers or customers, the point of contact of the service providers/suppliers with the case company were interviewed. Suppliers were not included in the interviews because the suppliers to be investigated are all located and handled by the team in India. Due to the time involved in reaching out to the interviewees and limited period of this thesis, the suppliers were not investigated and considered out of scope. Overall, the interviewees were divided into three categories ï ZF Operators (functional experts/team members), ZF Manager, ZF External (service providers and customers) shown in the context diagram, figure 4.1.

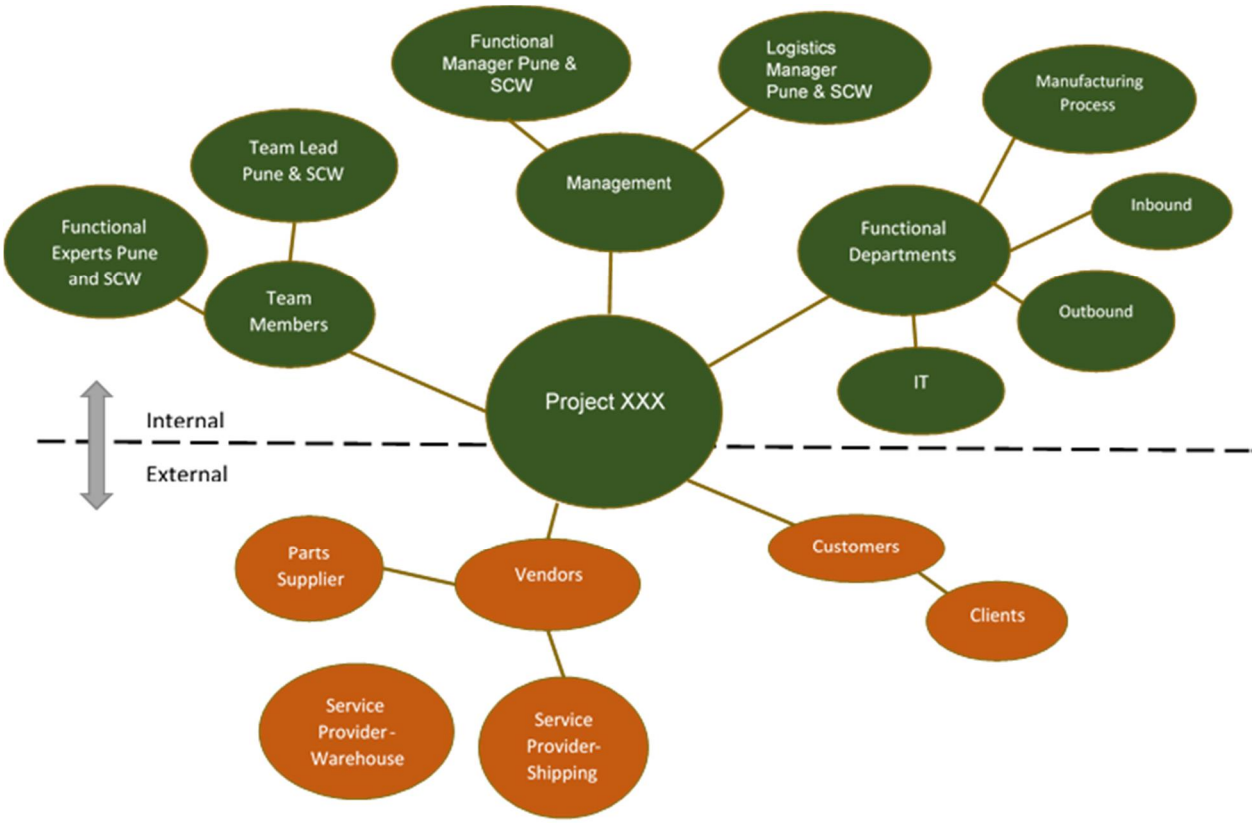


Figure 4.1 – Context Diagram (Cleland, 1998)

4.2.2. Interview Parameters

Based on the proposed framework presented in figure 3.1, the principles of process integration were taken into account to assess the present scenario at the case company. These parameters were further broken down into several questions to make it easy for the interviewees to understand and discuss. These questions lay down the structure for the interview questions, questionnaires. The relevant question domains can be checked in tables 2.1, 2.2, and 2.2 in Appendix 2 of the thesis. It can be seen from the tables, there are few questions, which may not be very relevant to the present case, and hence they can be discarded.

Table 4.1 describes how the topics of interview questions related to the theoretical findings. More detailed about interview questions and factors affecting can be found in the appendix table 2.1, 2.2 and 2.3.

Table 4.1 – Major topics for interview based on the literature study

Literature Parameters	***Related Interview Topics***
Accessibility	Ease of information exchange and understanding, Convenience level, and trustworthiness of the source - current and preferred scenario
Timeliness	On-time availability of information ï current and preferred scenario
Transparency	Existing clarity on the process, level of clarity required and consistency of information ï current and preferred scenario
Granularity	Conciseness of information communicated (short and clear), required level of detail present in the information communicated (completeness) - current and preferred scenario

4.2.3. Interview Protocol

The interview protocol here relates to the understanding of what kind of questions to be asked to the interviewees, how to follow up based on the answers, which areas to focus and how to present and conclude an interview. Usually, the first step was to prepare a list of questions as the category of the interviewee ï operator, manager or external. A questionnaire for each category was prepared beforehand. The preliminary interviews gave good insights and helped in preparing the questions. For all the interviews conducted, an email was sent to the interviewee explaining the intent and requesting an appointment along with the questionnaire in advance. The interviews were conducted via either Skype calls or face-to-face interview. The interview ranged from 30 minutes to one hour and then if required a follow-up call was arranged. Nineteen interviews were conducted out of 20 planned interviews - 11 operators, 5 managers, 1 customer, two service providers were interviewed to be precise. One operator was absent (Appendix 2). After every interview, the questionnaires were made more precise by deleting redundant or not relevant parts. All the interviews were recorded with the consent of interviewees.

4.2.4. Interview Data Synthesis

The interviews generated qualitative data, which was unstructured. While conducting each interview all the user responses were recorded in the same questionnaire excel. In the end, after completing all the interviews, a common spreadsheet was created containing all the answers (Appendix 2). Further, important answers or comments were marked down with red, green and yellow. *Red highlighted the issues, green highlighted the positive and the good things in the project, and the blue highlighted the improvement required or the existing needs.*

Most of the information collected was highly reliable and true because of the reason that the interviewees were also the problem owners. However, some interviewees did not respond to the best of their knowledge and their answers seemed to be politically correct or did not answer things directly or dodged the questions as they contradicted themselves and denied the existence of problems when all the other stakeholders accepted it. It is because of these reasons such interviews were given a special comment by the interviewer under interviewer comments in the common spreadsheet and such answers were not considered for any further analysis (Appendix 2). The structuring of qualitative data along with the demarcation of texts based on issues, positives and needs laid a good foundation for further analysis. All the fields marked with red were revisited and categorized based on the similar nature of the problem. For example, ónо purchase orders were received from Pune on-time by the order-processing department in SCWô was placed in the category of ï ówaiting for informationô Hence, the category of ñwaiting time for informationò emerged to cover similar issues as mentioned above. Based on the similarities amongst issues, 12 categories were identified. The categorization of issues was an iterative process that needs to maintain consistency in assigning issues to different categories. The 12 categories were accordingly mapped to the principles of process integration.

There were also instances where it was difficult to decide the categorization. E.g. during the structured interviews with project manager SCW, it was mentioned that the information conveyed regarding a particular task was not understood by the counterparts in Pune. In this case, it is possible that the counterpart did not understand an input even though all details were present in the information (case of transparency) but if the information was not understood because of incomplete information or missing details in the information then it is a case of granularity. Therefore, to mitigate these overlaps, a prioritization was made and used (Berente et al., 2009). The four principles of process integration can be split into two categories ï activities that transform information or transfer the information. Granularity and transparency imply the transformation of information either by detailing it, by summarizing it, or by standardizing it. While accessibility and timeliness do not imply a change in the information content rather they either pull, share or pass on the information to different parties (Berente et al., 2009). Since transforming information might add value to business processes, hence firstly it was checked if an activity relates to granularity or transparency and then timeliness and accessibility were checked.

The objective of the interviews was to create an information exchange map accurately which depicts the as-is scenario of the company. During the interviews, the customer-to-customer process flow of the company was identified in figure 4.2 that gives a high-level idea of interdependent departments. This figure helped in identifying the new departments in customer-to-customer map, further the departments were reinvestigated to map out all the activities and related information flows. Once an overall detailed AS-IS map is created

Figure 4.2 - Customer-to-customer process for project P2S based on interviews

Note: All the interview transcripts were condensed to make it short to fit in this report by picking up keywords from the original interview or in case of ambiguity using the same quotes from the interview to avoid biases (Appendix 2). However, all the original transcripts are available with the author and could be produced on request.

4.2.5. Interview Analysis

During the interview all the stakeholders, as identified in the context diagram (Figure 4.1), were interviewed. There were lot of issues mentioned during these interviews by different stakeholders and to identify their needs and analyze them, stakeholder analysis was carried out. The stakeholder analysis was completed in two parts ï first exploring the impact and importance of stakeholders in the project and second the relationship of the stakeholders amongst themselves.

During the first part, it was important to establish clarity on interests of stakeholders and their impact. Table 4.2 defines the interest of the stakeholders based on preliminary interviews and observations. It can be seen from the table 4.2 that customer and outbound activities are of prime impact for the project.

Estimation of interest and impact- The interest was annotated with High, Medium (Med) and Low impact level. These levels were decided based on how the project has an impact if the interest were not met. Since all the interest cannot be met at the same time a relative priority was given in the form of ranks 1 being the highest and 5 being the lowest (Cleland, 1998). The estimated project impact has decided based on interviews and observation. Afterward, it was verified with the company project manager and functional manager during a collective discussion. The comparison between the impact for service provider warehouse and the impact of team member interest was a major discussion. However, it was concluded that if an activity has a backup then its project impact will be medium or low based on the investment on the backup. If there is no backup method for the stakeholder interest then it will be a high priority. In this case, on-time pickup and delivery are not met then there will be a safety stock, which will cater to the need.

Table 4.2 – Stakeholder Interest and Impact adapted from (ODA, 1995)

Stakeholders	**Interests**	**Estimated Project Impact**	**Estimated Priority**
Functional Managers	Address the needs of a customer Increase revenue	High Med	3
Project Managers	Achieve target volume Timeliness of orders Smooth information flow	Med High High	2
Team Members	Achieve daily goals Clear and timely information Availability of Support	High High Med	2
Manufacturing Process	Efficient and Effective Production Fewer Defects and high quality Availability of equipment	High Med Med	3
Inbound	Orders processed on-time Levelled demand Parts availability	High Med Med	3
Outbound	Adherence to schedule On-time delivery	High High	1
IT	Smooth running of ERP systems Clear defined processes	Med High	4
Service Provider - Warehouse	Smooth dispatch and delivery Optimize inventory	High Low	5
Service Provider - Shipping	On-time pick-up and delivery	Med	5
Customer	High quality On-time orders Meet fluctuations in demand	High High High	1

Upon understanding the interest and priority of the stakeholders, a formal assessment was conducted to access the stakeholderôs importance and influence in the project. This assessment helps to pinpoint the areas of concern and highlight the focus of further design process (Smith, 2000).

Influence and Importance Diagram: The diagram was made based on interviews and observation. During the interview, it was found that the team members were not sure about a lot of information and were depended on their managers. Not all of the team members had clear information about the planning of the project or the proceedings. Upon, further following up the referred to their managers or functional leaders for more details. Hence, they were placed in the low-low quadrant of the graph shown below. On the other hand, the managers are the driver of this project hence they were placed in the high ï high quadrant. For functional departments and service providers, all the work procedure instructions, information exchange and organizational structure are pretty standard and set. They play an important role in the project but are not in influencing position. Therefore, an overall picture was created and which is reflected in figure 4.3. The figure shows a contrast between the project managers and the team members. This highlights the problem area, as stated in table 4.1 the team members or the functional experts should have relatively high importance in the project but it is the opposite.

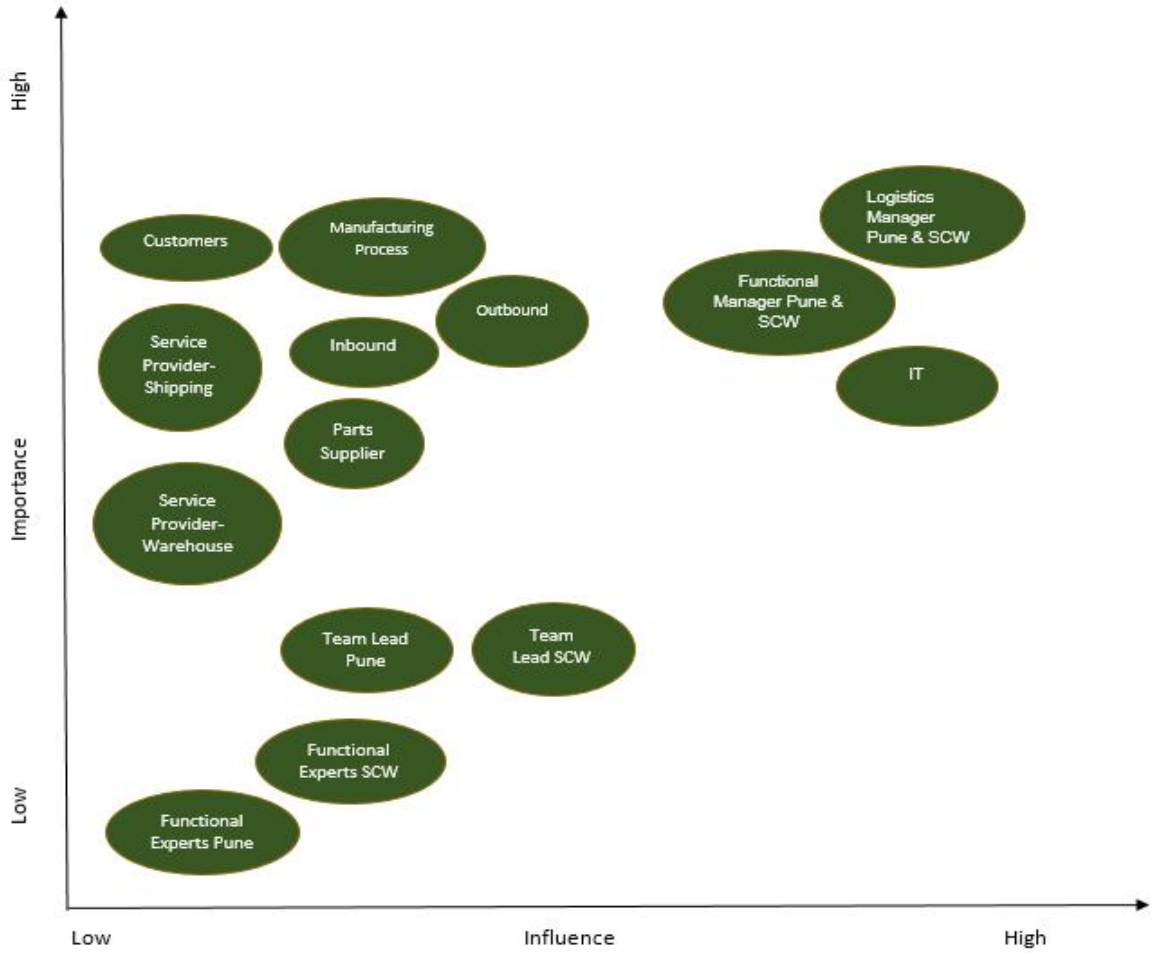


Figure 4.3 – Stakeholder Influence and Importance Diagram (Smith, 2000)

Analysing the results of the techniques until now, all the stakeholders were depicted with their interest and impact level. While the other stakeholders's position seems to be normal or close to what was estimated in table 4.2. The result displayed here is opposite to the expectation of the managers. During the interviews, the logistics manager SCW pointed it out that *teams should take initiatives by giving proper information and making sure they have all the information required or escalating if it is not proper.*

To understand the reason behind the result in figure 4.3, stakeholder relationship with each other was further explored via Stakeholder issue interrelationship diagram. This diagram shows which stakeholder is affected by what issues and how are they connected. The resulting picture in figure 4.4 shows the number of problems with the help of arrows. The management, the team members and functional departments share a common issue of undefined process flow. Likewise, the other stakeholders have issues within their group or with other stakeholders. All of the issues mentioned in the diagram below comes out of the interview data. The interview data was validated with the company supervisor and there was an agreement on the issues listed below.

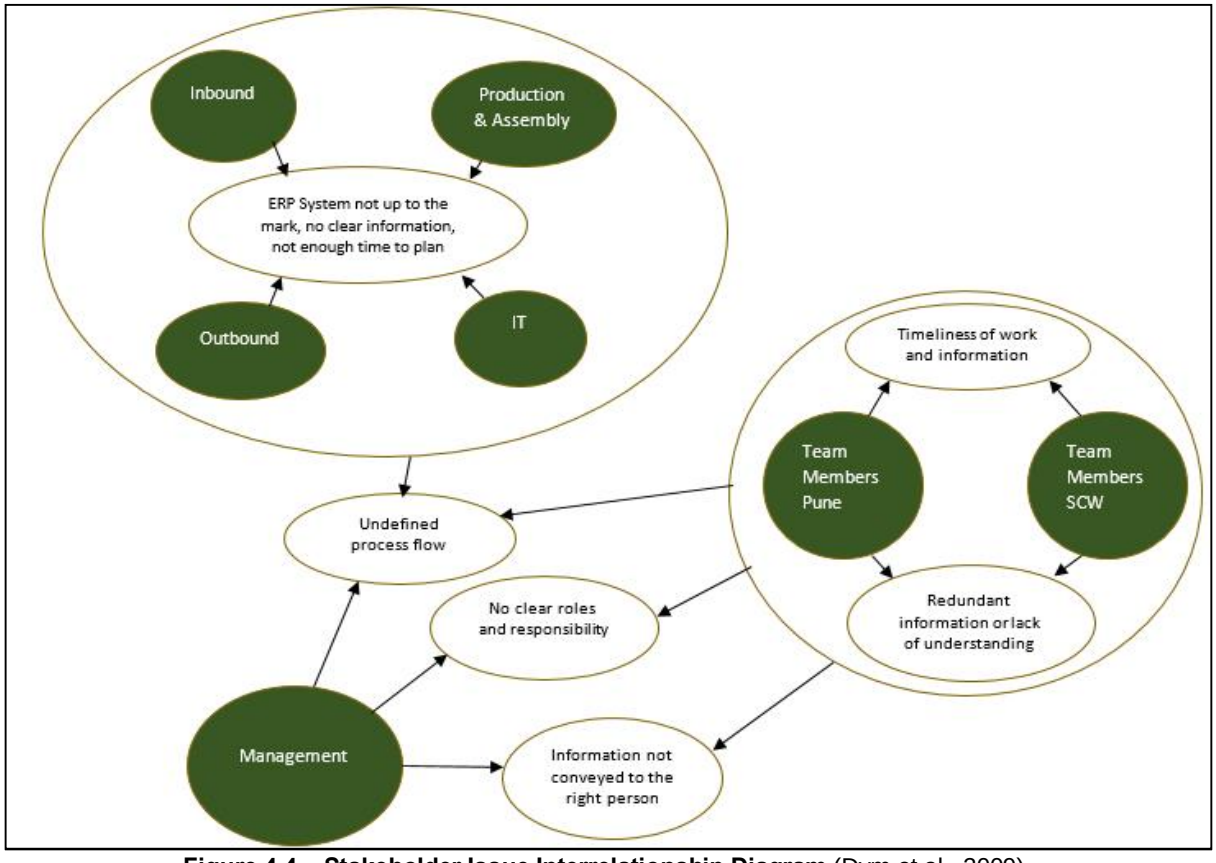


Figure 4.4 – Stakeholder Issue Interrelationship Diagram (Dym et al., 2009)

There was one additional important point that comes out of interviews is the topic of ***cultural difference***. It was found during the interviews that often the stakeholders gave politically correct answers or hesitated to speak out about the errors or gaps in

the project. The reason provided by the stakeholders at these instances was that they found it wrong to speak or be critical about the challenges and issues and insisted that it was not a right thing to do (Appendix 2). While on the other hand, stakeholders from the German side were direct in their reporting behaviour. They pointed out the mistakes or gaps and there was no hesitation as such. Further, it was pointed out during a discussion with the functional manager SCW, that the German and Indian teams interpreted the meaning of the phrases or words in a completely different way. For e.g. if an issue was responded by a phrase ñwe will look into itò meant to check the issue and report as soon as possible to German stakeholders. While the same phrase meant, we will see it later when time permits to the Indian stakeholders. Since the subject of cultural difference is quite vast and not the focus of this thesis, hence this will be ***out of scope*** and will be discussed in the ñDiscussions Chapterò at the end of this thesis.

4.3. Interview Results

Table 4.3 summarizes the needs and issues found during the interviews along with the occurrences. It can be seen that accessibility records the highest number of needs and issues along with transparency. The major issues can be listed as unclear information exchange map implies there is no clarity on information exchange between the processes. It was also one of the main requirements of this thesis to provide an information exchange map to the stakeholders so that they are able to visualize the information flow in the processes and understand the processes altogether. It can be mentioned based on all the interviews that nearly no stakeholders are clear about the information flow.

A second major concern is redundant communication. As mentioned by one of project manager/coordinator at SCW, there is a lot of redundancy in the communication. It was pressed upon that, the understanding seems to be one big concern during the interactions. The same information was clarified in person by sitting together and working out the solution together by documenting it but weeks later again a clarification was requested regarding the same thing. The issue of understanding information was categorized as transparency.

Table 4.3 – Categorizing the needs and issues as per literature adapted from (Berente et al., 2009)

Categories	Occurrences	Percent
Transparency	**23**	37
Need for clarification	3	5
Redundant communication	8	13
Difference in understanding	2	3
Unclear Information exchange map	10	16
Granularity	**11**	18

Incomplete information	6	10
Unspecific communication	5	8
Accessibility	**23**	37
Checking for correctness	4	6
Finding correct information source	4	6
Documenting work redundantly	5	8
Undefined roles and responsibilities	6	10
Transferring information from one department to another	4	6
Timeliness	**5**	8
Waiting for information	5	8
Total	**62**	100

Another important finding comes from the stakeholder analysis. The influence and importance diagram shows the team members in the low-low quadrant of the graph. A further investigation done with the help of Interrelationship issues map to understand the reason behind the team members position in the low-low quadrant. There is no intention to change the influence and importance of any stakeholder in the organization as it may further involve a huge impact on the organizational structure of the company. The only reason for exploring it was to check if there is an information flow gap between stakeholders. Figure 4.4 shows the issues related to all the stakeholders associated with the team members. The issues listed in the map comes from the interview data collection. These issues can be further seen in table 4.3. The issue of undefined information process flow corresponds to the category of unclear information exchange map of table 4.3 similarly all the issues from figure 4.4 are contained in table 4.3.

4.4. Participant Observation

4.4.1. Observation Events

Before starting the observations, the following events were considered: Weekly project meetings, and meetings for job specific discussion. Besides, it was also possible to be a part of communicating a project task to the team in Pune. All the stakeholders of the customer-to-customer process of the project P2S were also part of all the events observed.

4.4.2. Observational Data Synthesis

The observational objectives have been developed similar to the interview parameters. Based on the proposed framework presented in section 3.3 and figure 3.1, the principles of process integration were taken into account to access the present

scenario at the case company. These principles were observed in two stages ï descriptive and selective observation (Sekaran & Bougie, 2016).

For the descriptive stage the objectives as proposed by Spradley are ï space layout of the physical setting, physical elements such office tools, machines, equipment etc., relevant details of the actors, their actions, number of people in the meetings, people who stand out in the meetings, verbal behaviour, feelings or activities of actors, observation events used and their sequence. For the selective stage, the objectives as described by (DeWalt & DeWalt, 2010) are ï develop a storyline based on the events, actions and behaviour of actors, organize the details by sorting by common activities, including the variations in storylines as observed by different actors, and lastly find exceptions or new patterns. These objectives guided the observation and served as a checklist. The observation table is shown in section 2.5 of Appendix 2.

Based on the overall objective, which was to observe the information flow exchange between the processes and document the issues or instances associated with each task, segregation of data was conducted. All the quotes or information recorded which depicted an issue or fact was highlighted with colours red or green. Red colour represented the issues while the green colour represented the óalready havesò in the current process. All the issues in óredô were categorized based on the process integration principles, as mentioned in figure 3.1. Fourteen categories were highlighted. All the notes recorded manually during the observation was converted electronically with the help of Microsoft Excel. A number of times an issue was repeated by a stakeholder during the observation was counted and is referred to as an occurrence. For. E.g. if an issue is repeated by two stakeholders then the occurrence value will be two. It can be noted that the maximum value of an occurrence is equal to the maximum number of participants during an observation. Explaining the above example again, the occurrence value for an issue is two out of 15 occurrences possible (if total members during observation were 15).

4.4.3. Observational Protocol

The observational protocol here relates to the preparations to be made before conducting the observations and during the observations. The first step is the self-presentation during the event. There should be a clarity made to all participants about the role of observer for an event along with informed consent and confidentiality of the discussion. The second point is a prescriptive one; the objectives of the data collection should be clear and understood before participating in an observational event. This makes easier to sort the information during the observation event, as sometimes, the observation was carried out along with the interviews in parallel. Thirdly, it is important to decide how long the observation should be carried out to get enough data or insights. Since the general aspects of the project were already known from the interviews conducted and being physically present in the company for over 3 months, the goals of descriptive observation stage were already met. For the selective

observation - three weekly meetings and structured interviews were conducted. A lot of information, issues and concerns were getting repeated and redundant by the end of the third weekly meeting. Hence, a decision was made to stop the observation after the third weekly meeting. Lastly, it was checked if all the key points were noted during the observation, a follow up was done in case anything was not clear and a word of thanks was conveyed to show the appreciation for the people who contributed to the study (Sekaran & Bougie, 2016).

4.4.4. Observation - Analysis & Results

The interview and observation findings suggest that meetings, skype voice calls and emails are the methods used for communication and exchange of information flow from one team to others if they are not co-located. During the interviews, it was mentioned that often there are too many people involved in the meetings and sometimes there is a misrepresentation of stakeholders. Also during the observation, it was noted that sometimes there too detailed information discussed or high level. This makes it irrelevant for many people in the meetings. Hence, the information flow for the meetings to make the communication efficient. ñThe gaps in information flow during the team meetings can lead to lack of coordination, as members involved in the meeting have different levels of information access and may not all be present during decision-making processò(Demiris et al., 2008).

During an observation in project team meetings, it was noticed that often the interdependent departments were not coordinated with each other and discuss their issues in the main project meetings. This led to the shift of focus meetings discussion the overall status of work to the operational activities of the departments. Since everything was discussed in one single meeting, it becomes too difficult to manage time. Hence, there is a need to increase the efficiency of these meetings.

The table below (table 4.4) shows the number of occurrences for each category and a percentage it contributes in respect to overall occurrences. Undefined roles and responsibilities amongst the accessibility category are the most common of all with 17% of total instances. The unclear roles and responsibilities imply that who is accountable for what for e.g. ï Currently the project teams in SCW faced many troubles while finding the right connection for the purchasing department in Pune. They interacted with 5 -6 different people for the same task and none had all of the information. It is confusing for the team in SCW who are largely dependent on information exchange from their supply chain partners. They are not sure who to contact or check to get the desired information. It is important to note that, even the teams in Pune are not sure about their roles that the managers have not defined it yet. The functional experts lack influencing power as already shown during stakeholder analysis.

The second major issue is unclear information exchange map. The stakeholders are interested in knowing the information flow, which represents how information flows from process A to process B for an instance. This issue highlights the category of transparency.

Table 4.4– Findings of Observation adapted from (Berente et al., 2009)

Categories	Occurrence	Percent
Transparency	**12**	32
Need for clarification	2	5
Redundancy in communication	2	5
Difference in understanding	3	8
Unclear Information exchange	5	13
Granularity	**4**	11
Incomplete information	3	8
Unspecific communication	1	3
Accessibility	**16**	42
Checking for correctness	2	5
Finding correct information source	3	8
Documenting work redundantly	3	8
Undefined roles and responsibilities	5	14
Transferring of information from one department to another	3	8
Timeliness	**6**	16
Waiting for information	4	11
Waiting for personnel	2	5
Total	**38**	100

4.5. AS-IS MAP

The interviews conducted gave insights about the new customer-to-customer process and a basic outline is formed in figure 4.2. However, there is still a need to elaborate and identify the activities related to sub processes along with related information flows to generate an information exchange map. The interviews held previously helped to identify the key stakeholders for the respective departments that can be contacted to understand the related activities in detail. Figure 4.2 is used an input for the discussions. The final objective is to identify the activities and the related information flows for all the sub processes mentioned in customer-to-customer map figure 4.2. Participatory discussions were conducted with the functional experts (team leads and experienced team members).

Constituents of the discussion

A set of constituents were used to structure and facilitate the discussions. Based on the six P's of collaborative workshops from the literature (Gottesdiener, 2010), the constituents for the discussion were decided for all discussions to be carried out in this thesis.

1. Requirements – What is needed to enable discussion?
2. Participants – Who is involved?
3. Planning – Schedule, venue?
4. Agenda – Why need this discussion?
5. Findings – What decisions, plans and ideas emerged?
6. Validation of results – the results need to be validated before the next discussion

Requirements: To facilitate the discussions with the interviewees, there is a need for visualization to make sure that the interviewee and the interviewer were on the same page. Hence, a customer-to-customer map was created based on the information available before each interview. For the first interview, the order processing team lead was provided with a primary level map of customer-to-customer process developed based on interviews and observations (figure 4.2). Similarly, for every next discussion, the map developed in the last was used to visualize the information flow and check its validity.

Participants: The participants of these discussions are –

- Order Processing Project Functional Expert SCW
- Supply Chain Department Project Lead Pune
- Supply Chain Department/ Material Planning Functional Expert Pune
- Production and Operations Project Lead Pune
- Dispatch and Delivery Functional Expert Pune

Agenda: The purpose of these discussions is to map the activities of each department included in the customer-to-customer process of the project TCR and validate the map developed after the interviews and observations.

Planning: The discussion was planned based on the chronological order because it makes it easy to understand for the process flow for both the participant and the host. Also, since every department describes its input and output, this information is cross validates by other interdependent department and makes the information map more trustworthy. A time slot was booked with the interviewees in advance.

Findings: Due to the limited time for the discussions, the following steps were undertaken to use the time effectively.

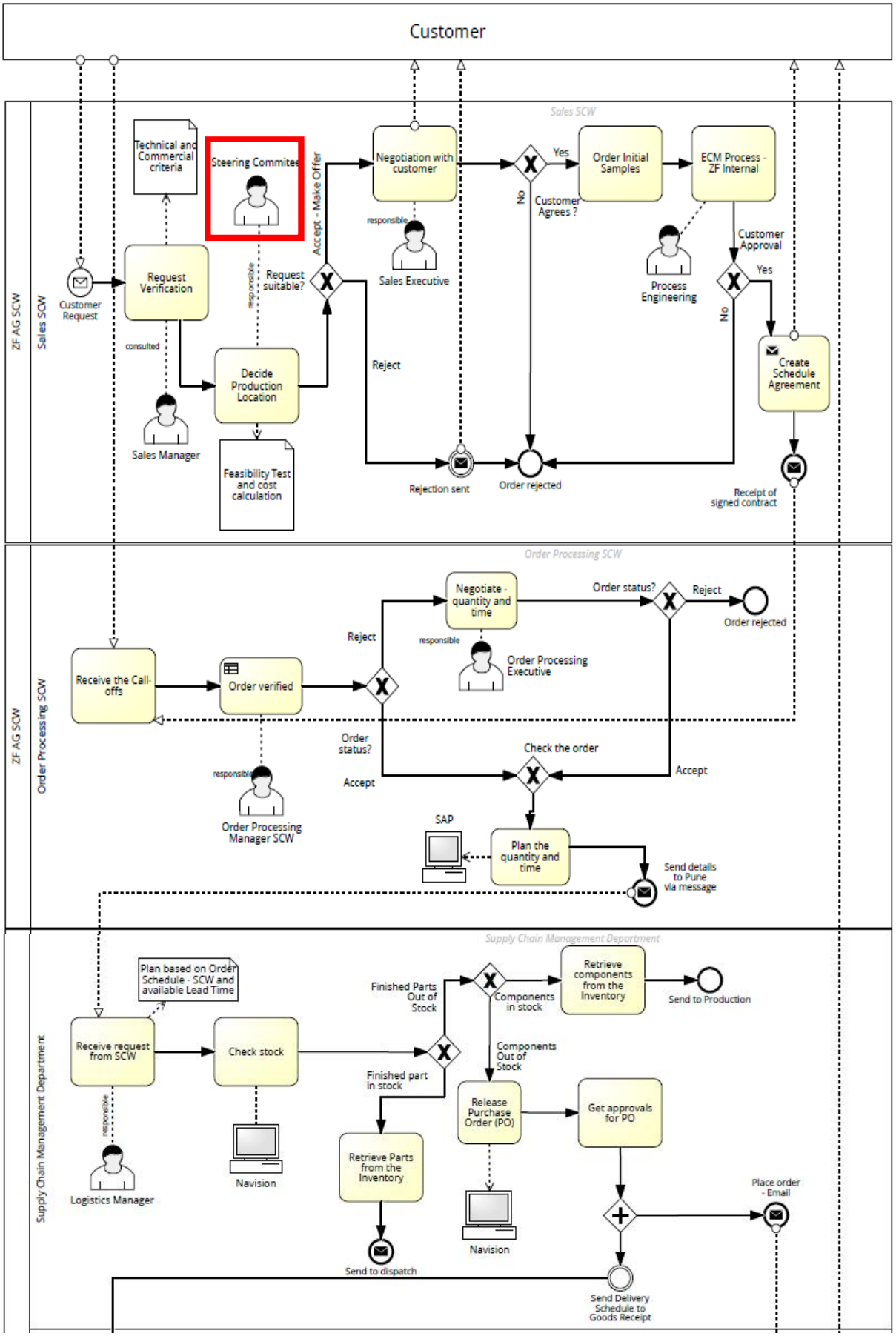
1. A brief introduction was given to the participant along with the developed information flow map for the visualization. For every discussion, the visualization was updated by including the results from the last discussion.
2. It was realized that the respective departments lack visualization of how information flows from SCW to Pune. Since departments in SCW and Pune have been doing similar activities for different projects over the years and they know everything, but there is no formal process that is hard followed.
3. Figure 4.5 is the overall output for this discussion. A comparison can be made with the two diagrams to understand the level of detail was required in the process.
4. Figure 4.5 shows that the mode of transport used was airfreight, which shows that there was a time delay in goods delivery.

Validation of the Result

The result of this discussion was validated with the help of logistics manager Pune and SCW. Two important points were further improved and included in figure 4.5.

1. Logistics Manager Pune ï The moment call offs are received with the supply chain department, it is sent out to production planning, material planning and process engineering simultaneously.
2. Logistics Manager SCW ï The activity of deciding location for production done by the steering committee and it is not a formal group. Also, the information flow across the sales department and the interrelated departments were explained.
3. As mentioned above, the sales department does not participate in a regular customer-to-customer process but it was still chosen to be a part of the as-is diagram. It is important to have an overall picture that gives the stakeholders a complete idea of the process. Besides, the regular process does not involve any decision making, only the sales department together with the steering committee makes a decision and rest everything is followed. It will be interesting to see how decision-making affects the whole process and it can play an important role in designing the future information flow for project P2S.

The final AS-IS map is presented in figure 4.5, the map is created using Business Process Modelling Notation and Responsibility matrix (the choice of tool is explained in chapter 5).


Customer
ZF AG SCW
Sales SCW
Technical and Commercial criteria
Steering Commitee
Negotiation with customer
Yes
Order Initial Samples
ECM Process - ZF Internal
No
Customer Agrees ?
responsible
Sales Executive
Process Engineering
Customer Approval
Yes
No
Customer Request
Request Verification
responsible
Request suitable?
Accept - Make Offer
consulted
Decide Production Location
Reject
Sales Manager
Feasibility Test and cost calculation
Create Schedule Agreement
Rejection sent
Order rejected
Receipt of signed contract
ZF AG SCW
Order Processing SCW
Negotiate - quantity and time
Order status?
Reject
Order rejected
responsible
Order Processing Executive
Receive the Call-offs
Order verified
Reject
Order status?
Check the order
Accept
Accept
responsible
Order Processing Manager SCW
SAP
Plan the quantity and time
Send details to Pune via message
Supply Chain Management Department
Supply Chain Management Department
Plan based on Order Schedule - SCW and available Lead Time
Finished Parts Out of Stock
Components in stock
Retrieve components from the Inventory
Send to Production
Receive request from SCW
Check stock
Components Out of Stock
Finished part in stock
responsible
Release Purchase Order (PO)
Get approvals for PO
Logistics Manager
Navision
Retrieve Parts from the Inventory
Navision
Place order - Email
Send to dispatch
Send Delivery Schedule to Goods Receipt

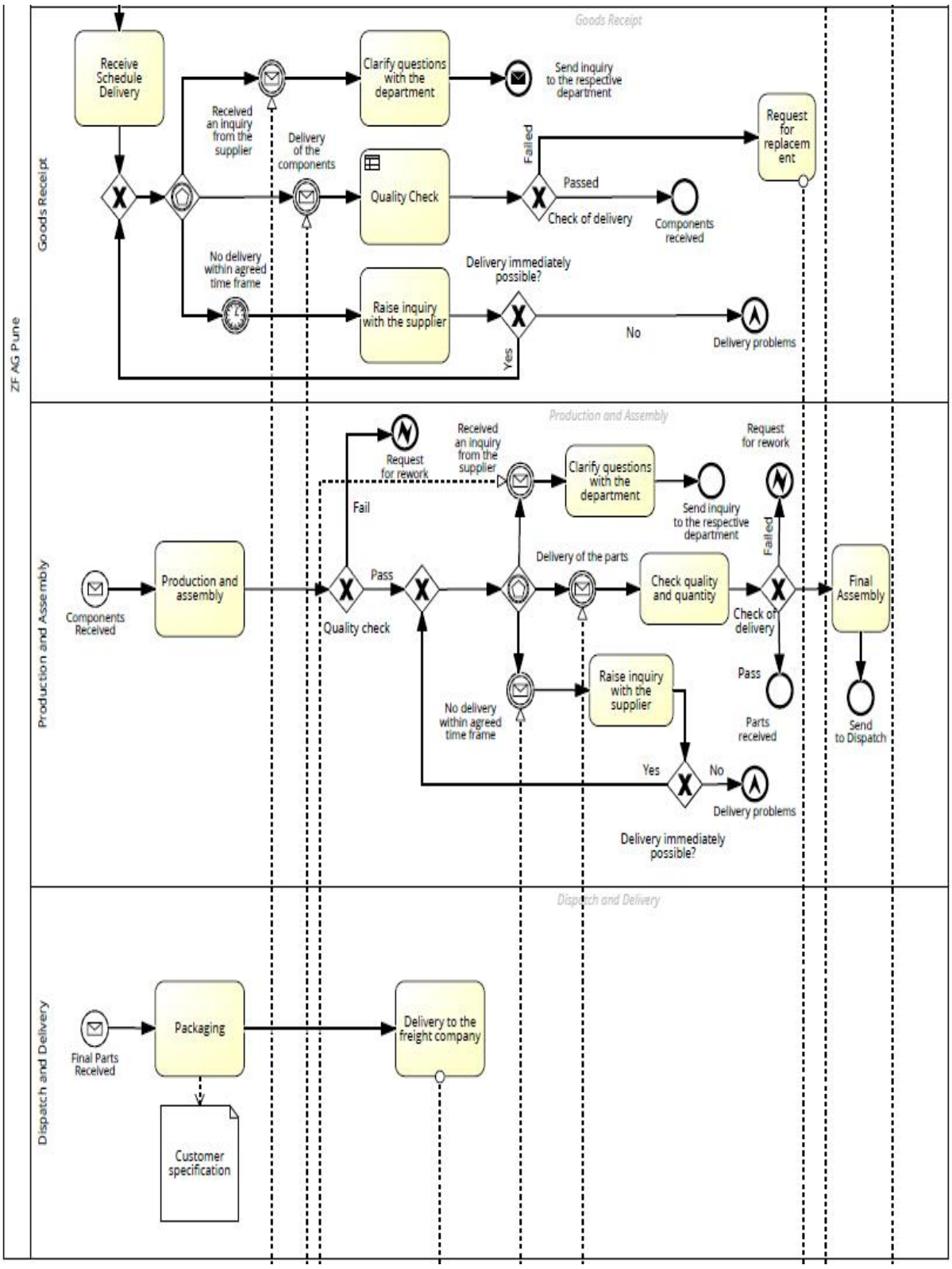
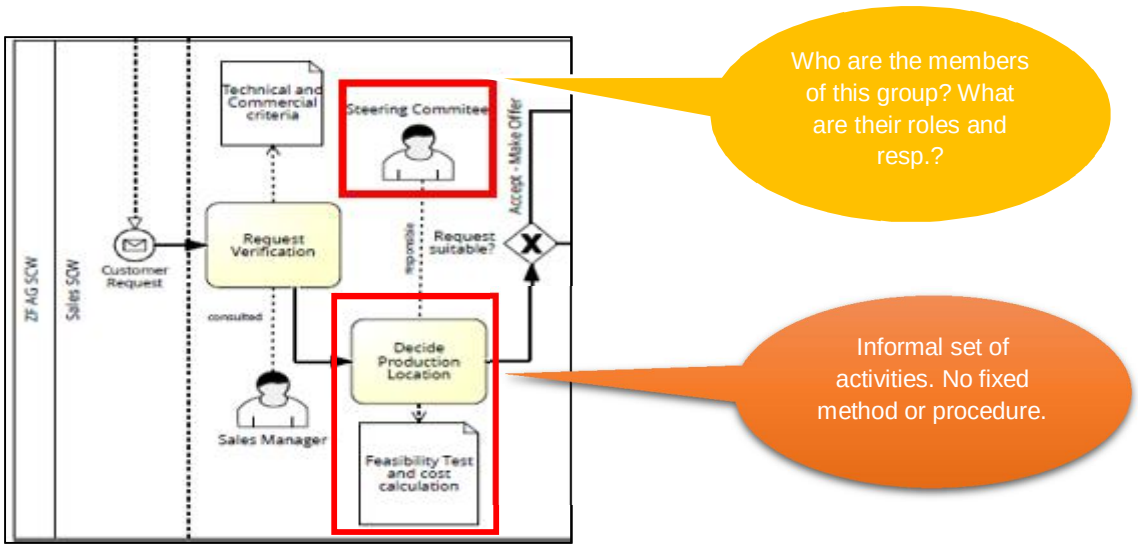


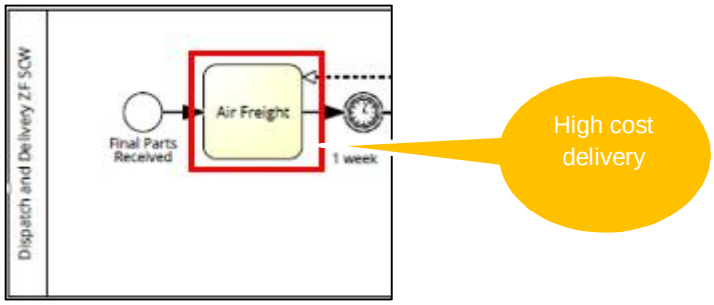
Figure 4.5 – AS-IS Customer-to-Customer Map for Sample parts production Project P2S

4.6. Analysis – AS-IS MAP

The mapping of the current scenario ï AS-IS map, pinpoints the issues in the project and visualizes them. As pointed out in the introduction chapter 1, the project currently faces an unclear information exchange map and it is not clear how information flows from one activity to the other. It can be seen that the just by the creation of an AS-IS map brings out clarity in the customer-to-customer process. Even after the interviews, it was not clear how the activities are connected and there was a lot of speculation, but the Delphi technique used for the discussion has made it possible to list all the key activities of each department. However, there is still a need to improve this map to mitigate the major issues in the project. One important area can be highlighted in figure 4.5, is the role of the steering committee. Talking to the management and other managerial level stakeholders, made it clear that this committee is an informal group that takes decisions related to production location. However, *the roles and responsibilities of the group are also not fixed and clear*. The steering committee involve functional managers of SCW and there is no representation from Pune.



Another important point that came into flight was that the final dispatch of sample parts involved airfreight delivery. Airfreight delivery are of the key indicators of logistics that shows the inefficiency, delay of the supply chain (Functional experts SCW, Appendix 2). The reason pointed out during the interviews was that there is an issue with the *timeliness of information*. The information is not readily sent out but rather it has to be requested repeatedly to know the order status, etc. pointing towards *redundancy of information*. Closely analysing the AS-IS map, it can be seen that the entire department work independently in a sequential manner. It points out that the departments have a local focus (case of local optimization) and not holistic focus (system optimization).



4.7. Final Results & Data Triangulation

Table 4.5 shows the combined issues found out from observations and interviews. Issues regarding accessibility tops the list with a total of 39% issues of all the problems listed. Both the interviews and the observations found similar issues except for timeliness. The reason for timeliness seems less prevalent during interviews while more during the observation, because during the project meetings there were a couple of instances of misrepresentation from a department, i.e. there was an absence of required personnel from a department in a project meeting. Due to this, the discussion points of the meetings to be conveyed to the missing personnel happened with some time delay.

It is important to note that, in section 3.8 an AS-IS map was created to visualize the current activities and associated information flows. All the major issues like unclear roles and responsibilities, timeliness of information, redundant information and unclear information exchange in the customer to customer process which were found from observations and interviews matched the issues found during the analysis of the AS-IS map. Thus, the data from the empirical analysis is triangulated.

Due to the limited time of this thesis, not all needs or issues can be addressed. A prioritization is made to decide the design requirements. Prioritization is done based on the total percentage mentioned in table 4.5 and top four categories were picked as it could be addressed within the time frame of this thesis. Unclear information exchange tops the list with 15%, second undefined roles and responsibilities (11%), third redundant communication (10%), and fourth waiting for information (9%).

Table 4.5 – Findings from observation and interviews adapted from (Berente et al., 2009)

Categories	Occurrences (Interview)	Percent (Interview)	Occurrences (Observation)	Percent (Observation)	Total	Percent
Transparency	**23**	37	**12**	32	35	35
Need for clarification	3	5	2	5	5	5
Redundant communication	8	13	2	5	10	10
Difference in understanding	2	3	3	8	5	5
Unclear Information exchange	10	16	5	13	15	15
Granularity	**11**	18	**4**	11	15	15
Incomplete information	6	10	3	8	9	9
Unspecific communication	5	8	1	3	6	6
Accessibility	**23**	37	**16**	42	39	39
Checking for correctness	4	6	2	5	6	6
Finding right information source	4	6	3	8	7	7
Documenting work redundantly	5	8	3	8	8	8
Undefined roles and responsibilities	6	10	5	13	11	11
Transferring of information from one department to another	4	6	3	8	7	7
Timeliness	**5**	8	**6**	16	11	11
Waiting for information	5	8	4	11	9	9
Waiting for personnel	NA	NA	2	5	2	2
Total	**62**	100	**38**	100	**100**	100

5

Design Requirements

5.1. Design Requirements

Based on the final findings found in the last chapter, there are four design needs to be addressed in the final design. The four design need to haves are further explained below.

5.1.1. Defined information exchange in the processes

This design need corresponds to the unclear information exchange issue listed out in chapter 4. The customer to customer process at the case organization is split between different department in ZF SCW and Pune. It is very important to coordinate activities between these two locations to ensure seamless production and operations in Pune and SCW. Currently, the customer-to-customer process for the project P2S is not defined in the case company. The project is in starting phase and sample parts are being produced in Pune for the customer testing and verification. The flow of information for sample parts between ZF SCW and ZF Pune has not been transparent. It can be explained by the insights gathered during interviews and observations. The project lead SCW mentioned that there are understanding issues with the information exchange. Mostly because the process flow in the current project is undefined and not clear which makes it hard to follow. At another instance, the logistics manager SCW also mentioned that a clear picture of how activities or tasks are related to each other is much needed. It will be a foundation for a smooth start and then the process can be further optimized if needed (Appendix 2).

Mapping of information exchange is highly required in the customer-to-customer process of project P2S, and it is also demonstrated by the AS-IS map (figure 4.6). By mapping the information flows collectively together with the stakeholders of the process will lead towards a mutual agreement between all the stakeholders and a common structure will enable smoother information exchange in the future. The AS-IS map created needs to be improved by defining and resolving issues between the stakeholders. With an updated AS-IS map (new design), a fixed information exchange

map will be achieved. It will be easy to understand the process and clarify the information expected out of any activity. It is highly important the new design should be made together with the stakeholders because ultimately they will be the users of the design.

5.1.2. Defined roles and responsibilities

The second issue that was highlighted in the final findings was the undefined roles and responsibilities. There is a need for defined roles and responsibilities that increase the accessibility in the information exchange. Responsibilities are assigned to roles and they collaborate to complete an activity. A good process has to be structured to effectively fulfill the responsibilities (Wirfs-Brock & McKean, 2007). Processes involve interdependencies and these interdependencies have to be coordinated to work in cohesion (Malone & Crowston, 1994).

Defined roles and responsibilities appeared to one important need of the project P2S, as mentioned by the stakeholders during the interview (Appendix 2). Logistics manager and functional manager SCW mentioned it during the interviews. For instance, to get status of purchase orders a number of discussions took place and every time it was a different person. ñIt is hard to coordinate for the teams located remotely to each other if there are no clear roles and responsibilities definedò ï Logistics manager Pune (Appendix 2). Other managers agreed this issue and functional experts are well during the interviews. This need also caters to the main deliverables required by the case company.

Accessibility, as defined in the literature (Culnan, 1984), has three dimensions ï ease of use, convenience, and reliability. It implies that the user of the information should be sure about the dependability of the information and it should be available when required. Additionally, there should be a relative convenience from other methods available to access the information and easy to connect or contact (Lee et al., 2002). The proposed need for defining roles and responsibilities when decided mutually with all the stakeholders becomes a common standard accepted by all. Additionally, it was found during an interview that ñIf we know who is the person then we can conveniently connect to each other, rather than asking a bunch of people and then coming to that person.òï Purchasing functional expert SCW.

5.1.3. Efficient Communication

Efficient communication emerges out to be the need based on the highlighted issue of redundant communication. Efficient communication is meant to be in a way where there is negligible redundancy of information and low transaction cost to the company (P. R. Smith & Taylor, 2004). The information should be understood the way it is meant to be. There is a need to understand the content of the information such that all parties

understand the same implied meaning, which indicates it needs participation from both sides ï listener and speaker (P. R. Smith & Taylor, 2004). If a participant does not understand an input, it becomes an issue of transparency but at the same time if there is a need of extra information or more details then it points towards the granularity of the information. In addition, if the information has to be searched then the information has to be accessible or it can be a possibility that the participant has to wait for information. It can be seen that there are very thin boundaries and overlap; therefore, there is a further need to clarify which part of the information properties requires more attention in the present context.

It was mentioned in the interview that ï there is a need for clear understanding. Communication is not a problem, but it is not hard following. Information is available to all parties involved (not a case of granularity) but often there is a request for more clarification (transparency). Example: The quantity and time schedule was sent out to the concerned department to help them to plan their activities but it was not understood by the receiver. The same information had to be mentioned repeatedly by the sender (Appendix 2). The above instance depicts that information details were present and the responsible department was known as well. However, there was not enough clarity for the information. Hence, it is established that effective communication implies transparency in the context of this case study.

5.1.4. On-Time information exchange

The issue that corresponds to this need is waiting time for the information. As shown during the analysis of AS-IS map in the previous chapter. The need for the timely transfer of information has been a major requirement for interdependent processes to work together in the project P2S. The scheduled delivery of the parts was postponed two times because the information exchange was not on time. Example: During the project meetings, it was mentioned that only 15 sample parts were delivered to SCW while there was a request of 38 sample parts from SCW. There was no information provided to SCW until the dispatch department received the parts. The information was conveyed only after SCW received the parts. This delay of information had a high impact on overall schedule deliveries. The customer needed all 38-sample parts together for the testing and verification before they can establish a contract with the case company. Hence, the rest of the parts were delivered using airfreight that involves high cost, to prevent a significant delay in the project (observation table). Another instance was observed while executing a task of requesting a proposal for packaging to the Dispatch department at Pune. The proposal was received later than agreed upon, with no information until the proposal was received. However, the task did not affect any other dependent task since there was an overall delay in the project (observation table appendix).

Based on the instance described above, there is a significant need to address the issue of ówaiting for informationôby on time information exchange (Table 4.5).

5.2. Summary

Figure 5.1 depicts the schematic diagram of relationship between issues, design needs and design functionality. The top four selected issues were discussed and four corresponding needs were determined. The arrows in figure below show how an issue correspond to which design need and in turn which required functionality (integration principle) is served. Four design requirements that will be the inputs to the design are ï defined information flows in processes, defined roles and responsibilities, efficient communication and on time information exchange.

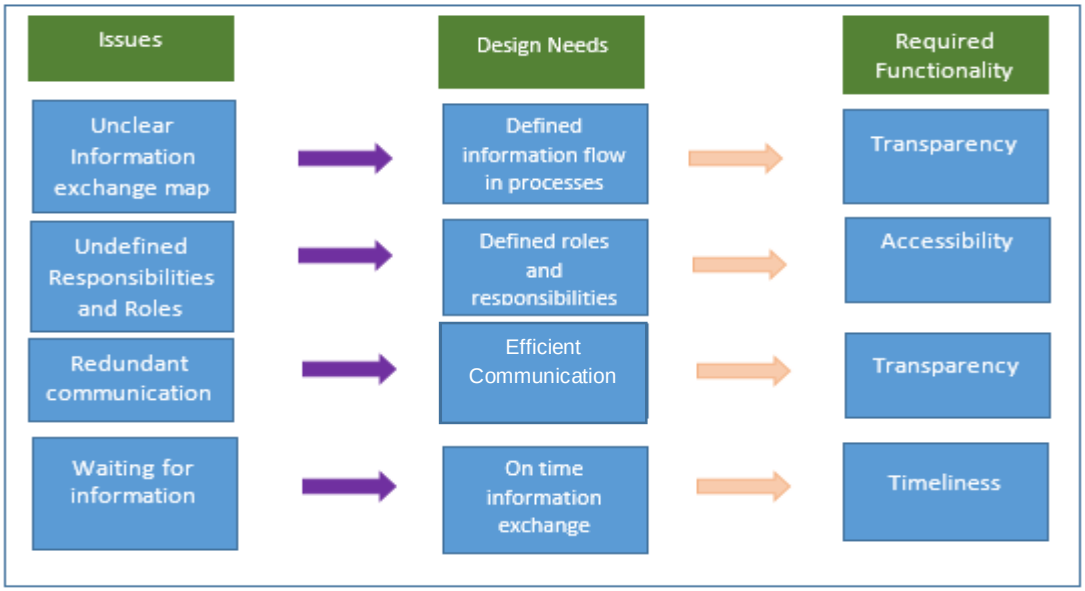


Figure 5.1 – Issues, needs and functionality relation

6

Conceptual Design & Participatory Design

6.1. Conceptual Design

The design requirements defined in the previous chapter (5), are the main goals to create a conceptual design. To meet the design requirements, a common strategy of an implementation of information standardization is suggested by the literature (Davenport & Brooks, 2004) (Volkoff et al., 2005) (Berente et al, 2009).

Standardization offers many benefits. Firstly, it lowers overhead costs. With one defined process there will be a need of one process owner, less redundancy in information, Secondly, with fixed actor involved responsible for a process, the service providers, other teams, customer, etc. will have a single point of contact, thus reducing transaction cost for the involved parties. Thirdly, process standardization can increase organizational flexibility (Hammer & Stanton, 1999). However, all the stakeholders involved in the process must collectively agree and believe in the standard approach. As described by one of the project leads during an interview that to define a standard, it is important to collect data, check, improve, and define it together with all the key participants of a process. Then it should be communicated to all the members. Participatory design is one such approach, where all the stakeholders come together and give feedback on the current situation to improve. The major reason to choose a participatory design for this thesis was the involvement of multiple stakeholders in the customer-to-customer process and also the stakeholders will be the user of any new design. The user participation helps to check if the idea proposed by literature or empirical research would work in a practical setting of the company or not. The mutual discussions to evolve a design gives the users a sense of ownership and not just a prescribed design recommended by an individual. Also, since the design will be developed together with the users, it will have comparatively less resistance from the stakeholders as participatory design fosters greater involvement and strengthens the bond between stakeholders (ñWhat is Participatory Design?,ò2019).

6.2. Proposed Solution

To standardize the information flow, as discussed above, all the four design requirements were listed and corresponding methods to fulfill the needs were searched in literature. Defined information flows in the processes could be achieved by mapping the information flows between the processes with the help of user participation. Standardization of business processes are the building blocks that enable information flow within an organization or outside organization. The key business processes have to be identified and correlated with corresponding information flow (Gerrits, 2016). Hence business process modelling was chosen as a method to map the information flow, section 6.2.1 discusses it further. For defining roles and responsibilities, a concept of responsibility matrix is proposed (Gautier, 2010). Responsibility matrixes are one of the most popular and commonly accepted techniques used within business organizations. The next two requirements can be fulfilled by setting up rules for information dissemination during team meetings (Demiris et al., 2008). The proposed method will be designed with the help of participatory design to fulfill the requirements and solve the need of the users. The two methods proposed need to be implemented together as one relates the other. The figure 6.1 sums all the requirements and corresponding solutions. Business process model will map the information flows and give clear pictures to the users and at the same time, the information sharing rules improves information exchange during team meetings. Hence, the business process model together with rules will serve as an appropriate solution that will help to build the final design.

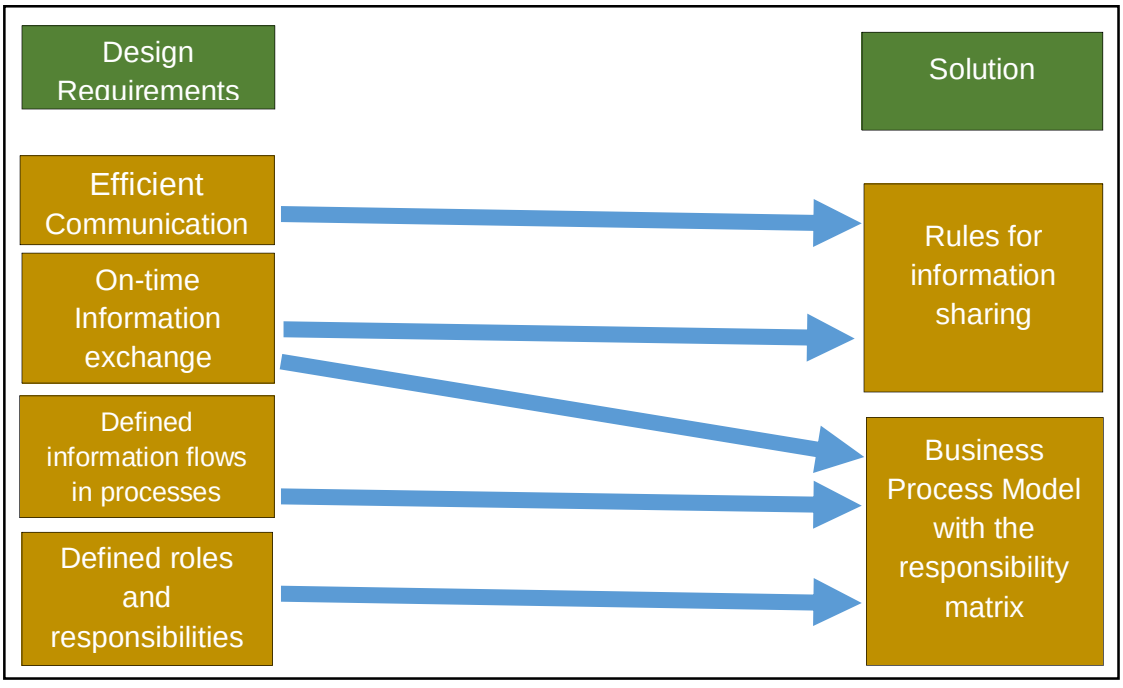


Figure 6.1 – Relationship between design requirements and design ideas

6.2.1. Tools for Information Exchange Map - BPMN and RASIC

Requirements for modelling business processes are that they should communicate the whole process and give a big picture to people so that all the actors are on the same page. The models should ensure the quality of the analysis and design process (Gerrits, 2016). Business process modelling is one of the most used and accepted methods to depict the information exchange map between the processes. The Business Process Management Initiative (BPMI) created a standard notation Business Process Modelling Notation (BPMN) which is accepted and understood by all business users being an industry standard (White, 2004). The major reason to use BPMN was the organizational fit with the company. The process manager at the quality department of the case company mentioned the usage of BPMN in different process management groups within the company. BPMN is a simple notation that helps to create business process models. It includes the few basic categories, which makes it easy to understand for all users. The basic categories are ï flow objects, connecting objects, swim lanes, and artefacts. Flow objects are the rectangular boxes for tasks and activities, diamond boxes for converging or diverging sequence flows and small circles that indicate start, end or intermediate events, which happens during between the processes. Connecting objects are the arrows, which shows sequences (solid arrows), dashed arrows show message flows and the dotted line shows an association. Swim lanes are the graphical containers for partitioning departments or set of activities. Lastly, artefacts are the data objects, which provides extra information needed for a task or a sequence in the form of annotations (White, 2004). But there is often a need to define and identify the task of each member in a process which includes multiple stakeholders of a supply chain, which can be accomplished by RACI (Responsible, Accountable, Consulted, and Informed) matrix (Sahin & Robinson, 2002).

Prune Gautier (Gautier, 2010) presents a RACI Matrix for coordination and communication discussed in the context of an automotive part supplier company working at two geographic locations. The RACI Matrix is a tool that allows employee and manager to know the responsibility and information communication flow for a particular task. A new approach is proposed BP model with complete responsibility information (RACI aware BP). This leads to a balanced BP model according to the functions defined in RACI. Thus, it was concluded that the use of RACI matrices together with business process models manage human resource responsibilities in processes. The assignment of responsibilities and the management of processes can be designed separately while being executed together (Cabanillas, Resinas, & Ruiz-Cort´es, 2012). The software used to model using BPMN and RACI was Signavioô Business process model academic initiative (academic.signavio.com). The model was plotted using BPMN technique and the key activities were linked with the corresponding stakeholder.

6.2.2. Rules for Information Sharing

Based on the observational analysis (section 4.4) on project meetings, two major elements are missing from project meetings ï a structure of the project meetings and guidelines (or rules) to facilitate these meetings (Davey, 2016). Project meetings are one major source of information exchange along with skype calls and emails.

The literature (Demiris et al., 2008) mentions the importance of three components ï introducing a facilitator, structured documentation and accessibility of information to all team members to be formed as rule the efficiency of meetings. Another literature (Schwarz, 2013) points out that some ground rules to conduct meeting helps to make the information sharing much efficient. However, these rules can be procedural like ï start on time or do not be late are useful but do not help effective information sharing, other abstract rules are ï show respect to other people. The rules do not specify what to do make sure people are respected, or different people may have a different idea of respecting others. Therefore, behavioural rules are advocated as superior to the other two by being specific and useful for information sharing. There are eight such ground rules discussed in the literature (Schwarz, 2013) such as ï state views and ask genuine questions or share all relevant information or focus on interests and not on positions. To structure meetings, there are two popular approaches ï top-down or bottom-up approaches (Codella, 2018). The top-down approach is usually determined before the process, the information flows from top management to the team members and usually the subsequent level follows the decisions coming from top management. However, to the contrast bottom-up approach involves team members in the process and information flows starts from them and reaches top management. Due to the involvement of team members, there is an active contribution of team members in the information chain which boost up their morale and often leads to higher productivity (Codella, 2018).

These points can play an important role in information sharing between the teams in SCW and Pune during project meetings. All the literature findings (above) will be facilitated during a collective discussion with the stakeholders to select the applicable rules and structure.

6.3. Assumptions

Since not all the interview and observation results could be included in the final design, therefore few assumptions were made to develop the design.

1. **External Stakeholders**
    - Due to the nature of the project and confidentiality, the interviews could not be conducted directly with the client. Hence, a customer care executive was asked to answer questions based on her past interactions. The executive is the point of contact between customer and company for past three years.

4 ï See appendix 1a

- The vendor for the warehouse is not yet decided and the negotiations are still in progress. The functional expert responsible for the warehouse selections was asked to answer questions based on the proposals made to the service provider.

2. **Functional Department- IT**
   - Currently, there is no EDI connectivity with ZF Pune. However, it has been proposed that by the end of December 2019, the IT team would be able to achieve it. This fact is considered while designing the information map.

3. **Process**
   - The customer-to-customer process to be designed has to be used for serial production and not for sample parts production.

6.4. Participatory Design Discussion – New Design

This discussion started with an information map developed for AS-IS situation during empirical analysis. The final objective of this discussion is to identify the points of improvements in the information flow amongst the activities. This decision was made to visualize the difference of understanding between two teams (Pune and SCW). The discussions were conducted separately to understand the viewpoints of the two teams at two locations.

6.4.1. Constituents of discussion sessions

Requirements

Figure 4.6 the AS-IS map made during the first discussion is the input for this discussion. This figure served as the visualization for the discussion and every time a new detail was known, it was added to form a new picture. Since there were many iterations made to develop a future scenario, not all pictures are included in this thesis. Only first (figure 4.6 chapter 4) and last (figure 6.2) have been kept for the design phase in the thesis.

Participants

Logistics Department SCW

- Logistics Manager
- Functional Manager Project P2S

Logistics/SCM Department Pune

- Logistics Manager
- Project Manager

The choice of participants is related to the fact that the managers are the drivers of this project and have most of the knowledge. Logistics Manager SCW is the owner of the project from SCW together with the functional manager as a supervisor. Logistics Manager Pune and Project Manager Pune are the one driving the project from Pune. Being the drivers of the project, the power of making changes and decision-making lies within this group of stakeholders.

Planning

The diagram below shows the sequence of the discussions conducted. Each discussion is planned for 45 minutes to one hour. An invitation was sent to each participant before the discussion for the selection of date and time. Face-to-face interaction was held for the participants from SCW and others skype voice call was used to facilitate the discussion.

Agenda

- Introduction and clarification of diagrams used for visualization. (5 minutes)
- Validation of AS-IS diagram
- Discussion on points to improve and include
- Agreement on the understanding of the results from the discussion.

Discussion Points

- During the discussion with the project manager Pune, it was mentioned that there is no setup present in Pune which can make decisions based on the orders received from SCW and update them at the same time. At the moment, all the requests from SCW are pending as no one had an idea of how to deal with them. Hence, there is a requirement to set up a project management team in Pune, which reviews the order as per available resources and then informs SCW respectively.
- Managers in SCW were able to clarify the roles and responsibilities of people involved from SCW. E.g., the order processing team lead will be responsible for receiving call offs, levelling customer demand, sending EDI to Pune and requesting warehouse for a timely delivery. The suitable role and responsibility for the point of contact in Pune were also discussed. However, this has to be validated in the next discussion. Another major point of discussion was about the timeliness of the information. A suggestion was made about having timely information to order processing department about any delays or issues related to the delivery of goods.
- Logistics Manager in SCW also proposed a formation of a formal group called program management team consisting of members from SCW and Pune. This

group will be able to setup all the requirements for new orders during the start of a customer contract. This fosters partnership with Pune and there is an equal share of accountability for both teams in SCW and Pune.

- The idea of forming rules for the information flow during the meetings was discussed with the managers and was well received. Functional expert SCW mentioned that they are currently conducting meetings in a similar way but there are no rules for these meetings. The idea to structure the meeting seemed interesting as well. It was acknowledged that there has to be a proper meeting structure and it is missing in the current project. Currently, there is one meeting for all discussions and there are too many participants in it. Therefore, it was mutually discussed and settled that there is a need for two types of project meeting ï management level and cross department for operational level discussion.
- Management level meeting will include functional managers from Pune and SCW along with project managers. Operational level meeting will include team members with project managers. Bottom-up approach was selected for the information exchange because of the organizational fit. The shopfloor meetings are also conducted in a similar way so bottom up approach suits best. Cross department meeting will discuss the issues and the unresolved issues would further go to the management level meeting that will be mainly a status update meeting along with troubleshooting unresolved issues.
- For the ground rules, behaviour rules were selected to be a part of ground rules for the project meetings. It was mentioned that participants should not hesitate to speak up, there is a need for shared and document all relevant information and there is a need to clarify doubts and assumptions.

Results of the discussion

- The results show that the teams in Pune and SCW have two different ideas for improving the current scenario and have different understandings about their roles during the start of the disuccsion. It was made clear by the functional manager SCW that Pune alone cannot make decisions for the orders. There has to be a collective decision making and once schedule agreements (contract between the customer and the company about the frequency of orders with a validity period) are made Pune cannot reject orders or decide. All the necessary resources (tooling, human resources, machines, suppliers, bill of material, etc.) and competencies will be checked and established by the program management team before scheduling an agreement.
- As pointed out during the discussion, there is a need for timely information flow between both the teams Pune and SCW. The AS-IS process was improved by establishing new information flows between production planner Pune with all the activities that involve a goods delivery delay outcome. The new information flow design pulls information from different activities to a centralized role in

Pune. The role is currently defined to be of a production planner but this is subject to further discussion, as Managers in Pune are the ones to decide on this.

- The discussion on meeting structure was not very clear as the solution discussed was still quite vague. To be specific, there is a need to rule out unwanted permutation and combination for operational level meetings. On further discussion together with the logistics manager, it was proposed that the operational level meetings can be divided into further three sub meetings ï Pune (internal), SCW (internal), and Pune ï SCW joint meeting. Firstly, intra facility (Pune or SCW) departments must interact and update across departments during internal meetings to discuss operational level details. Second, unresolved issues could be brought together to a joint meeting between Pune and SCW. This would provide a platform for cross facility discussion between teams to discuss issues and updates. And lastly, a managerial level meeting should occur for the status update of the project and to discuss unresolved issues from second level meeting. Sorting the team meetings this way, will sort the information flows as well. Operational teams get operational information while managerial teams get status updated. An overall picture is presented in figure 6.2.
- The participants of level 3 meeting should be functional experts from each department and department managers. Level 2 ï Project managers and departments managers and level 3 ï functional managers and project managers. However, the participants may or may not be added as per the requirements.

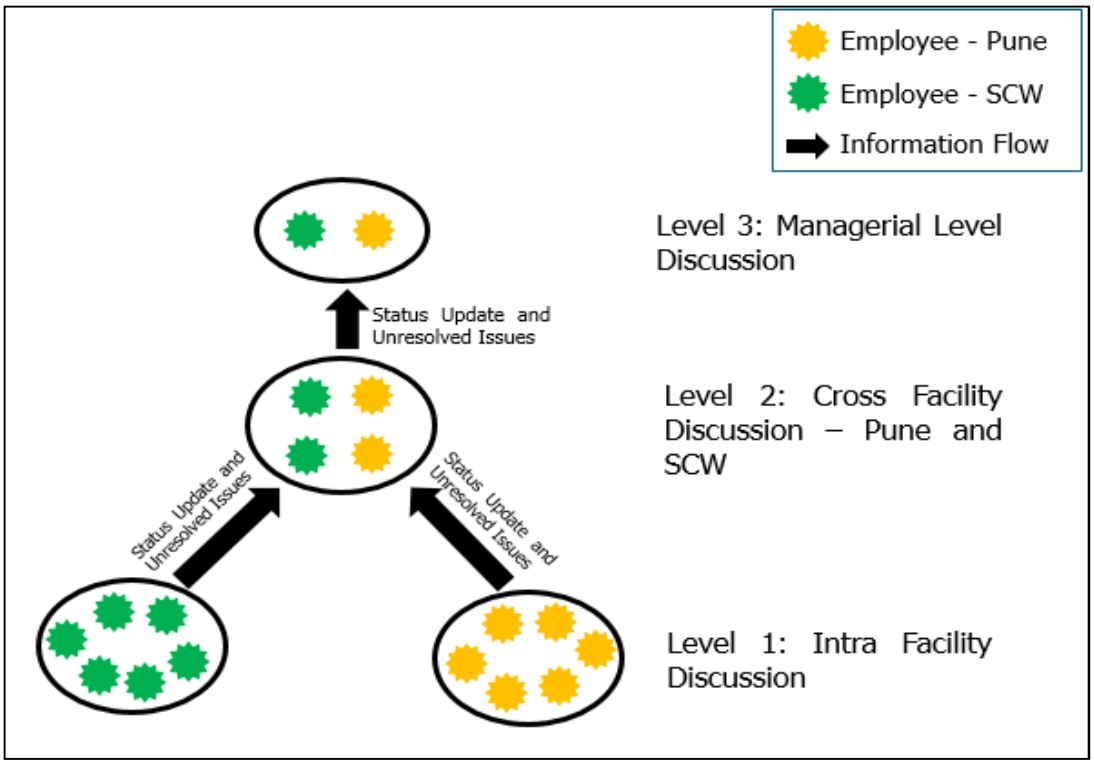


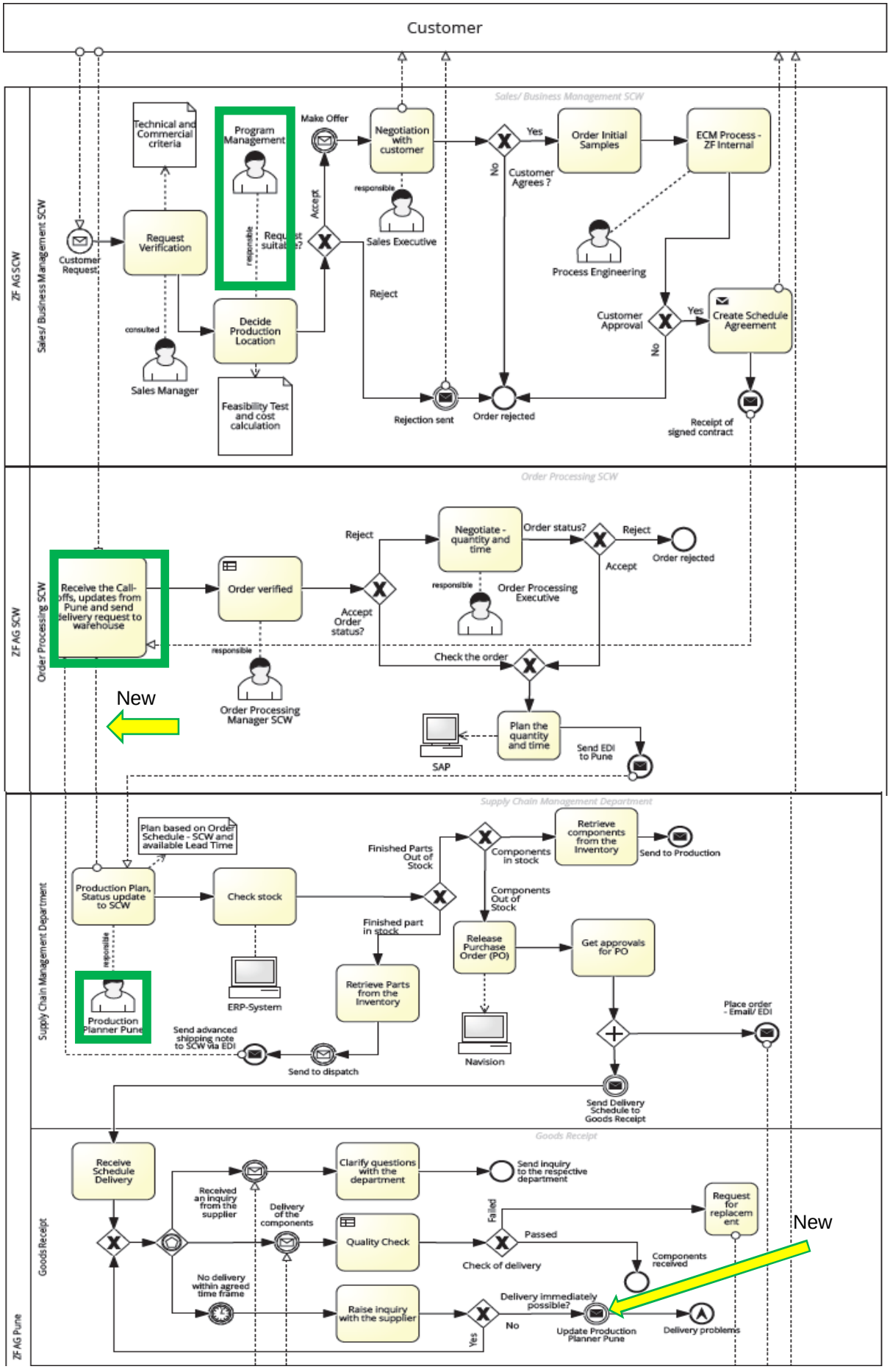
Figure 6.2 - A Bottom-up Approach: Meeting Structure for information Sharing

- Meetings rules as discussed:

    - **Use specific examples and agree on what important words mean.** This ensures that all team members are using the same words to mean the same thing.
    - **Explain reasoning and intent.** This enables members to understand how others reached their conclusions and see where team membersô reasoning differs.
    - **Test assumptions and inferences.** This ensures that the team is making decisions with valid information rather than with membersô private stories about what other team members believe and what are their motives.
    - **Jointly design next steps.** This ensures that everyone is committed to moving forward together as a team.
    - **Discuss undiscussable issues.** Do not hesitate to addresses the important but undiscussed issues that are hindering its results and that can only be resolved in a team meeting.
    - **Document and share all relevant information.** It includes documenting all the important points discussed during a meeting and sharing it with all the participants of the meeting.

Validation of Result

The functional manager SCW has validated the final output of this discussion. After a couple of corrections, the information flow design is ready for the collective discussion. The changes in the as-is process have been shown in figure 6.1. The green boxes show new role and tasks while the arrows represent a newly added flow to observe pull pattern of information flow. The pull pattern signifies that the information is requested from the activity to update interdependent activity (Bonney, Zhang, Head, Tien, & Barson, 1999).


Customer
ZF AG SCW
Sales/ Business Management SCW
Sales/ Business Management SCW
Technical and Commercial criteria
Program Management
Make Offer
Negotiation with customer
Yes
Order Initial Samples
ECM Process - ZF Internal
No
Customer Agrees ?
responsible
Sales Executive
Accept
Customer Request
Request Verification
responsible
Request suitable?
Reject
Process Engineering
Customer Approval
Yes
Create Schedule Agreement
No
consulted
Sales Manager
Decide Production Location
Feasibility Test and cost calculation
Rejection sent
Order rejected
Receipt of signed contract
Order Processing SCW
ZF AG SCW
Order Processing SCW
Receive the Call-offs, updates from Pune and send delivery request to wareHouse
Order verified
Reject
Negotiate - quantity and time
Order status?
Reject
Order rejected
Accept
responsible
Order Processing Executive
Accept Order status?
Check the order
responsible
Order Processing Manager SCW
New
SAP
Plan the quantity and time
Send EDI to Pune
Supply Chain Management Department
Supply Chain Management Department
Plan based on Order Schedule - SCW and available Lead Time
Production Plan, Status update to SCW
Check stock
Finished Parts Out of Stock
Components in stock
Retrieve components from the Inventory
Send to Production
Components Out of Stock
Finished part in stock
Release Purchase Order (PO)
Get approvals for PO
responsible
Production Planner Pune
ERP-System
Retrieve Parts from the Inventory
Place order - Email/ EDI
Send advanced shipping note to SCW via EDI
Send to dispatch
Navision
Send Delivery Schedule to Goods Receipt
Goods Receipt
ZF AG Pune
Goods Receipt
Receive Schedule Delivery
Received an inquiry from the supplier
Clarify questions with the department
Send inquiry to the respective department
Delivery of the components
Quality Check
Failed
Request for replacement
Passed
Check of delivery
Components received
New
No delivery within agreed time frame
Raise inquiry with the supplier
Delivery immediately possible?
No
Yes
Update Production Planner Pune
Delivery problems

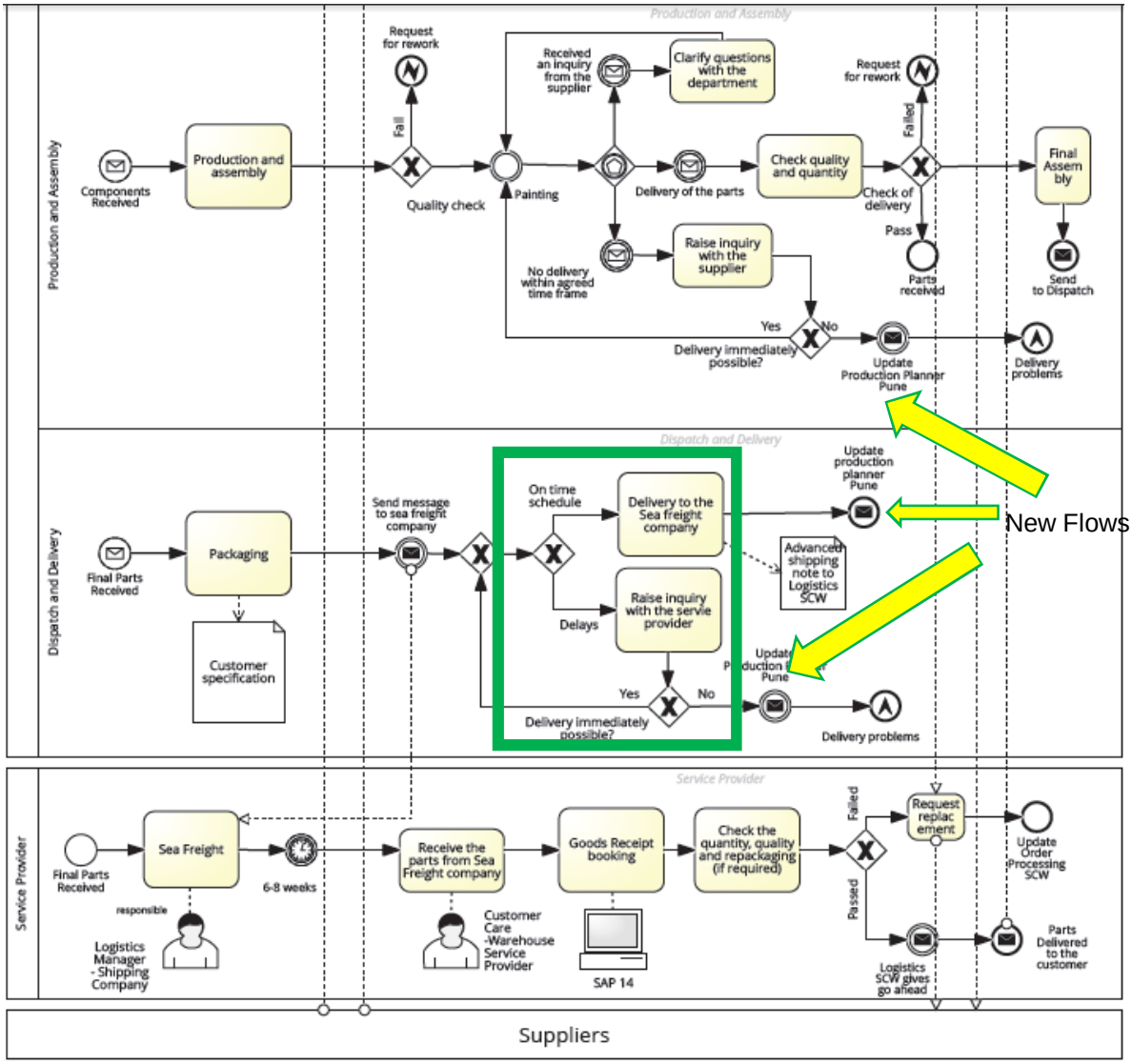


Figure 6.3 – Updated Customer-to-Customer Map

6.5. Requirement check of the final design

All the design needs are represented in the final design.

- **Defined information exchange in the process**

  The detailed mapping of information exchange in the current scenario of project P2S was defined after the first round of discussion (AS-IS map, figure 4.6). The analysis of AS-IS map pointed out the issues and improvements needed for the updated design. The updated design figure 6.3 represents all changes with green boxes and yellow arrows. The current final design identifies all the key processes and related information flows. The updated customer-to-customer map indicates information exchange as per the processes involved in serial parts production in project P2S. The map in figure 6.3 has been validated by

the functional manager SCW and was pointed out it will serve as a common standard to enable smooth information exchange in the future.

- **Defined roles and responsibilities**

  Another important aspect of the detailed design was the inclusion of the roles and responsibilities of the key stakeholders in the business process model. All the key stakeholders were highlighted in the information exchange map created along with their corresponding responsibilities (responsible, accountable, consult and inform) similar to that of the RACI chart. During the AS-IS map, an issue was pointed out regarding the steering committee and its role. The updated design now clarifies the role of that committee by forming a new group of including stakeholders from Pune in the decision making. The group is renamed to program management. Additionally, the point of contact of SCW and Pune was made clarified. Now, it makes clear for the stakeholders about who does what in the whole process. Since the roles and responsibilities are defined together with the business process model, it makes more convenient for the stakeholders to visualize the overall picture and identify the point of contacts. The logistics manager SCW mentioned that the information exchange map together with the identification of roles and responsibilities in the same picture makes it easy to connect the dots and use it further.

- **Efficient Communication**

  Efficient communication has been related to the transparency category of the information flows. The meeting structure together with ground rules was discussed. The structure of project meeting will help to eliminate unnecessary participants and two types of meetings will ensure all the stakeholders receive the information as they need. Manager will get a status update while team members will receive clarity related to their operational activities. The documentation of meeting points is an important aspect, which enhances efficient communication and brings everyone on the same page. Hence, the rules proposed by the end to discussion type three will be able to guide the efficient communication across the teams during the meeting.

- **On-Time information exchange**

  The need for the timely transfer of information is a major requirement for interdependent processes to work together (Malone and Crowston, 1994). Figure 6.2 includes green boxes and the arrows that represent a newly added flow to observe pull pattern of information flow. The pull pattern signifies that the information is requested from the activity to update interdependent activity (Bonney et al., 1999). It is similar to a control mechanism which will help the timely information exchange across the different activities and departments. Therefore, the need to improve information exchange in the processes has been fulfilled and the corresponding issue of waiting time for the information is

met. The improvements will be discussed during the design validation stage together with the managers.

Check List for Design

Table 6.3 – Design Checklist

Requirements of the final design	How it can be tested	Req. Met	References
Defined information exchange in the process ï Transparency	Ask the functional experts if they can find anything missing	Yes	Validated by functional manager SCW. The improvements suggested were included iteratively.
Defined roles and responsibilities - Accessibility	Combining all the related issues and answering them	Yes	The managers SCW were able to identify the roles and responsibilities that were not clear earlier.
Efficient Communication ï Accessibility	Check with meeting facilitators if the rules could help	Yes	Discussion with managers SCW suggested further discussion of this requirement with stakeholders from Pune.
On-Time Information exchange - Timeliness	Self-check, to see if the current delay in the project could have been avoided	Yes	This need comes from the AS-IS map and issues from empirical analysis. The inclusion of information pull control mechanisms was well received by the managers.

7

Design Validation, Results & Recommendations

7.1. Validation of the design

The validation of the design is done with an expert panel including managerial stakeholders from SCW and Pune.

7.1.1. Expert Panel Discussion

This discussion started with an information map developed based on the participatory design discussion in chapter 6 and updated customer-to-customer map, figure 6.3. The final objective of this discussion is to form a consensus on a unique information flow map by deciding roles and responsibilities, the newly added information flows and the information sharing rules. This discussion is a validation for the design developed by including improvement suggestion as well.

Requirements

Figure 6.3 and the information sharing rules for meetings were also introduced which served as the starting point of the discussion.

Participants

Logistics Department SCW

- Logistics Manager
- Functional Manager SCW

Logistics/SCM Department Pune

- Project Manager
- Functional Manager Pune

The choice of participants is related to the fact that the managers are the drivers of this project and have most of the knowledge. Logistics Manager SCW is the owner of

the project from SCW together with the functional manager as a supervisor. Due to unavailability of Logistics Manager Pune, Project Manager Pune is in-charge of the project together with the functional manager Pune. Being the drivers of the project, the power of making changes and decision-making lies within this group of stakeholders.

Planning

The diagram below shows the sequence of the discussions conducted. The discussion is planned for one hour. An invitation was sent to each participant prior to the discussion for the selection of date and time. Face-to-face interaction was held for the participants from SCW and skype voice call for others was used to facilitate the discussion.

Agenda

- Introduction and clarification of diagrams used for visualization. (5 minutes)
- Evaluation of design based on four process integration principles presented in the framework (Chapter 3).
- Validation of design and discussion on newly added information flows
- Agreement on the understanding of the results from the discussion.

Discussion Points

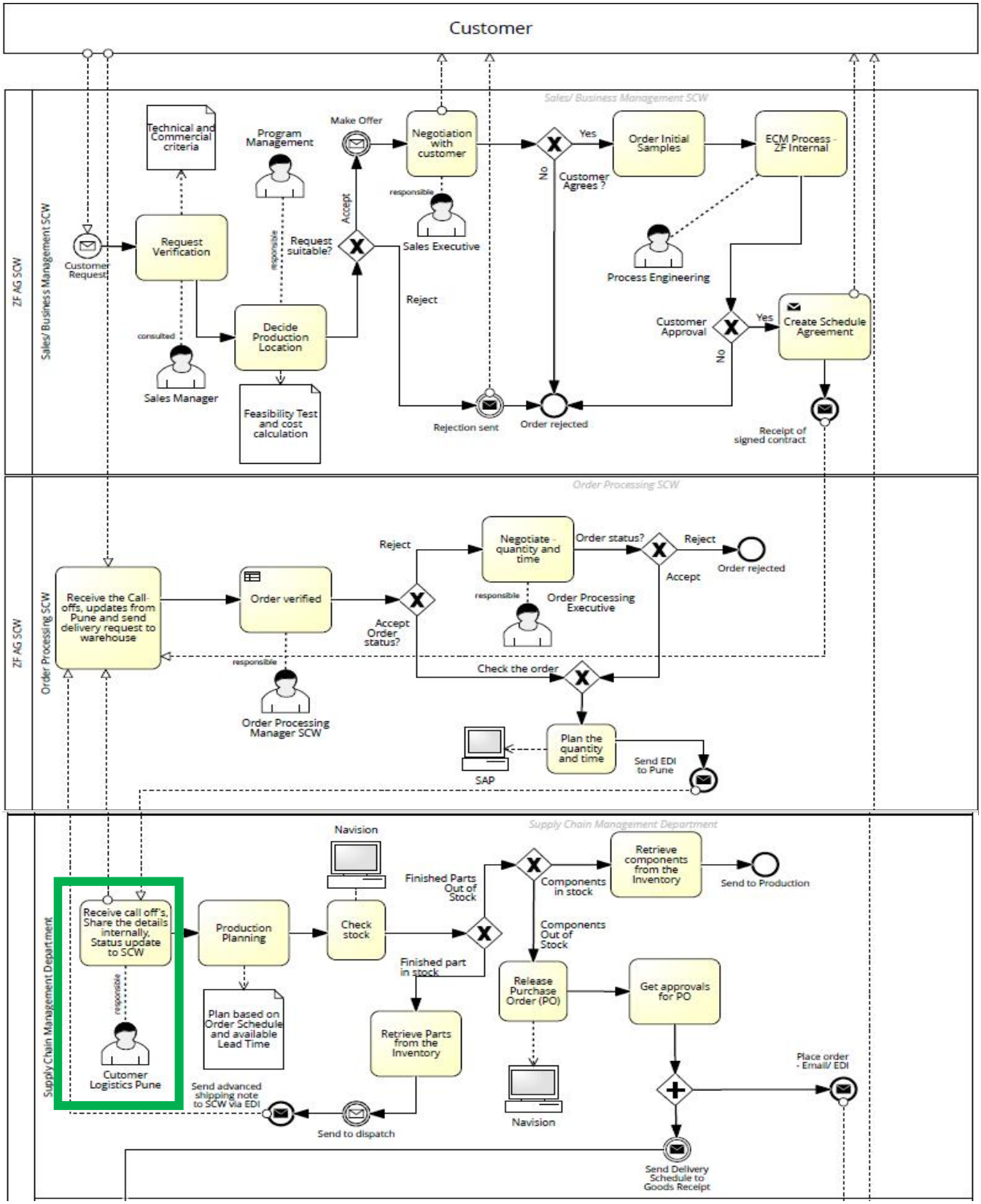
- The figure 6.3 was presented for validation. All the information flows present in the map were explained. There was a discussion on the activities present in the last swim lane of the map. The role of the actor receiving the parts from the airfreight was clarified. Further there was confusion about why SCW is checking the ógoods receiptô as it was the job of the warehouse service provider. However, it was later clarified that the warehouse service provider is not available as of now and it is planned for future deliveries.
- The updated customer-to-customer map was introduced for validation. The relative difference ï the inclusion of newly added flows and centralized gathering of information to the production planner Pune was explained. The functional manager Pune clarified that this was not possible as the organization structure of Pune is different from SCW. The role should be corrected and should be renamed to customer logistics Pune rather than production planner Pune. It is because of the reason that customer logistics should be the point of interaction with the customer. Customer Logistics responsibilities were defined as well. The new responsibilities include receiving customer request, forwarding the request details via sales and operation meetings to different departments - SCM, Purchasing, Production and Material Planning.
- All the managers mutually accepted the introduction of the program management team. This team will access all the requirements of the facilities

before making a óschedule agreementô The program management team will only work when there is a request for the new parts or during the start of the project.

- While discussing about the meeting structure, functional managers could relate with the way the shopfloor meetings are currently conducted in each facility. Since the structure was quite familiar with the employees, the proposed meeting structure was adopted from the next meeting onwards. The ground rules included the major points recommended by the functional managers during previous interactions and hence all the rules seems to be sufficient. .

Results of the discussion

- Timeliness and Accessibility - The results show that the teams in Pune and SCW have mutually agreed to the proposals of new team formation ï program management team (roles and responsibilities ï accessibility) and the centralized information control by customer logistics personnel (roles and responsibility, on time information ï accessibility and timeliness). The rules for the meetings were well-received (efficient communication - transparency). The functionality related to timeliness and accessibility were met.
- Transparency - There is a mutual agreement for common information flow map for the future serial deliveries and it serves as standard guidelines to follow or to resolve conflicts regarding roles and responsibilities.
- The input of this discussion figure 6.3 was updated by the changes proposed in the discussion and is presented in figure 7.1. The changes are represented by green boxes.


Customer
ZF AG SCW
Sales/ Business Management SCW
Sales/ Business Management SCW
Technical and Commercial criteria
Program Management
Make Offer
Negotiation with customer
Yes
Order Initial Samples
ECM Process - ZF Internal
No
Customer Agrees ?
responsible
Sales Executive
Accept
Customer Request
Request Verification
responsible
Request suitable?
Reject
Process Engineering
Customer Approval
Yes
Create Schedule Agreement
No
consulted
Sales Manager
Decide Production Location
Feasibility Test and cost calculation
Rejection sent
Order rejected
Receipt of signed contract
Order Processing SCW
ZF AG SCW
Order Processing SCW
Reject
Negotiate - quantity and time
Order status?
Reject
Order rejected
Accept
Receive the Call-offs, updates from Pune and send delivery request to warehouse
Order verified
Accept Order status?
responsible
Order Processing Executive
responsible
Check the order
Order Processing Manager SCW
SAP
Plan the quantity and time
Send EDI to Pune
Supply Chain Management Department
Navision
Supply Chain Management Department
Finished Parts Out of Stock
Components in stock
Retrieve components from the Inventory
Send to Production
Receive call off's, Share the details internally, Status update to SCW
Production Planning
Check stock
Components Out of Stock
responsible
Finished part in stock
Release Purchase Order (PO)
Get approvals for PO
Plan based on Order Schedule and available Lead Time
Retrieve Parts from the Inventory
Place order - Email/ EDI
Cutomer Logistics Pune
Send advanced shipping note to SCW via EDI
Send to dispatch
Navision
Send Delivery Schedule to Goods Receipt

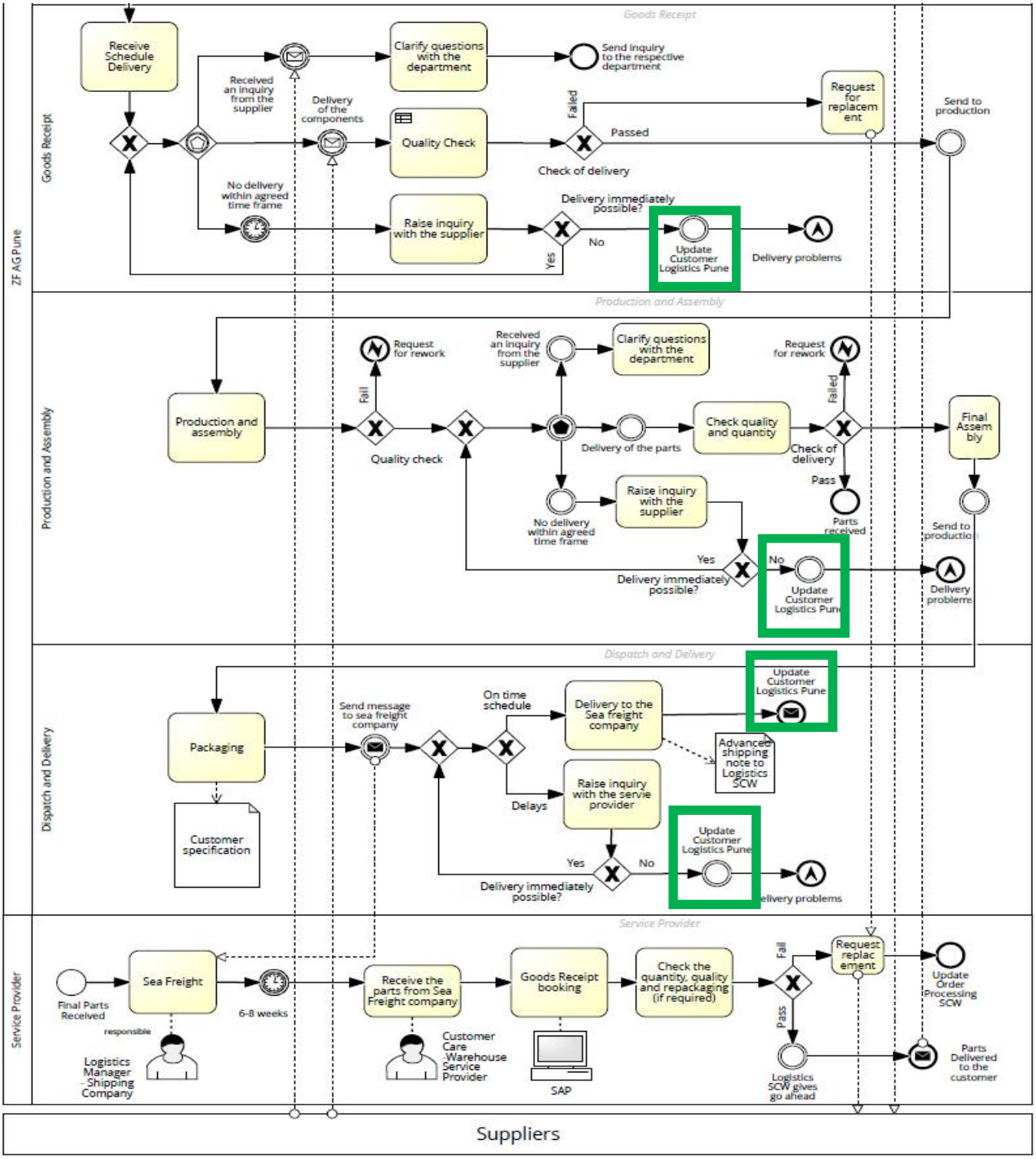


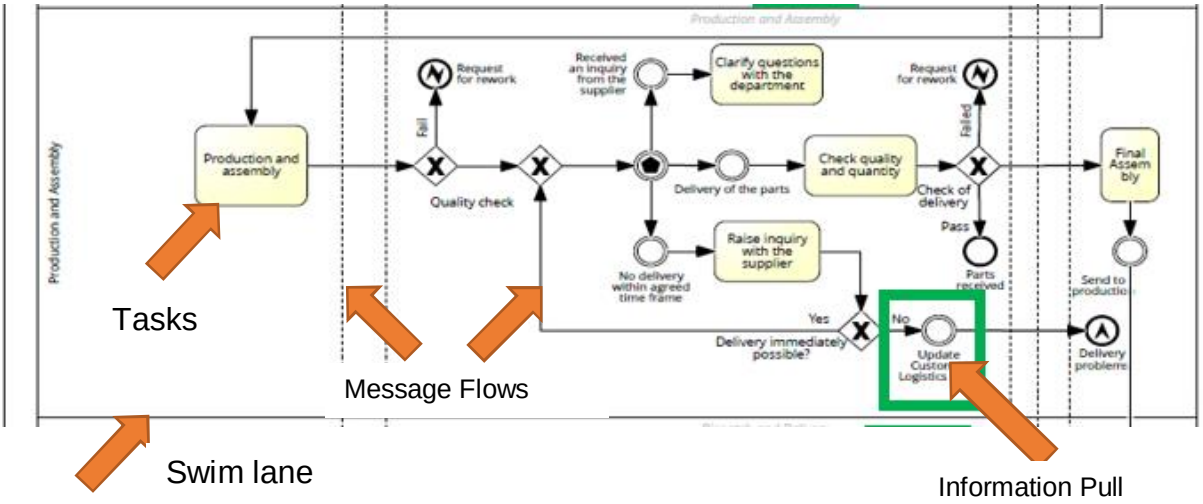
Figure 7.1 – Final Design for Customer-to-customer process for project P2S

7.2. Results – Deliverables

7.2.1. Design

The goal of the design was to improve the information flows in the case company by fulfilling the prime needs (design needs Chapter 5) of the case company. Figure 7.1 is the final design and deliverable of this project. The reason for the development of the information map together with the meeting structure and rules for information exchange was that there was a lack of transparency, accessibility and timeliness in the current information flow in the project P2S as per the data triangulation. The roots of these issues (chapter 4) come from undefined information exchange, undefined roles and responsibilities, redundant communication and waiting time of information.

The final customer to customer process design together with the meeting rules for information exchange helps to map the information flow between the processes, defines roles and responsibilities, enables efficient communication and on-time information exchange. In the final customer-to-customer diagram - the horizontal boxes (swim lanes) represents the different departments involved in the project P2S. The arrows show the information flows between the rectangular boxes (task and activities). The dotted line shows the flow message flow from one activity to the other, the activities present in one swim lane corresponds to the activities of a particular department and the pictorial representation of individuals shown in the diagram represents the roles and the corresponding responsibility.



The key stakeholder entities are identified as ï customer, sales/business management SCW, Order processing SCW, SCM Pune, goods receipt Pune, production and assembly Pune, dispatch and delivery Pune, service providers sea freight and service provider Warehouse.

The connection in the form of arrows (solid and dotted) between activities shows information flows amongst them. The diagram displays pulling of information from different activities to the customer logistics Pune. The main aim was to establish a centralized collection of information so that the customer logistics (who will also be the point of contact to SCW) is well updated on all fronts and is capable of updating SCW at any moment. On comparing with the AS-IS diagram, it can be seen that the information flow until now has been sequential and the pulling of data happened verbally that too with many layers of hierarchy involved.

The introduction of the program management team also helps the information flow. As of now, there is no fixed team. The as-is diagram shows the steering committee as the decision maker during the request of new orders but there is no fixed team and roles of this team. It has been an informal process until now. The new program management will be an official team of manager from Pune and SCW taking decision together. The team decide by conducting a feasibility test, which includes the cost estimation, new tooling, machinery, and other resources. Hence the new customer-to-customer map fulfils all the design requirements and improves the information flows.

7.2.2. Information Sharing Rules

The information sharing for project meeting as agreed during the final validation has two aspects ï structure and rules.

Structure

Figure 7.2 represents the final structure for the project meetings. The approach used in bottom-up where information flows from team members to the top management. The benefits of this approach are

- Involving functional experts bridge the gap between management and functional experts. They feel more involved. Hawthorne effect (Sekaran & Bougie, 2016) (Codella, 2018) comes into play. It was noticed by phycologists that paid attention to employees often leads to higher productivity.
- Organizational Fit ï The case company currently uses bottom-up approach in their shopfloor meetings and has been very successful. The presented structure follows the same approach. This makes it easier for employees to follow.
- Efficient communication ï Since there will be a clear bifurcation of information flows related to operational or managerial activities, stakeholders would easily associate themselves during the information exchange.
- On-time information exchange ï Depending on the frequency of these meetings as decided by the stakeholders will make sure that there will be a timely update on activities and stakeholders will be more informed.

Rules

- **Use specific examples and agree on what important words mean.** This ensures that all team members are using the same words to mean the same thing.

- **Explain reasoning and intent.** This enables members to understand how others reached their conclusions and see where team membersô reasoning differs.

- **Test assumptions and inferences.** This ensures that the team is making decisions with valid information rather than with membersôprivate stories about what other team members believe and what are their motives.

- **Jointly design next steps.** This ensures that everyone is committed to moving forward together as a team.

- **Discuss undiscussable issues.** Do not hesitate to addresses the important but undiscussed issues that are hindering its results and that can only be resolved in a team meeting.

- **Document and Share all relevant information.** It is important to document all the key points during a discussion to make sure all the participants in the meeting share similar understanding. Additionally, all the information needed to conduct a meeting should be shared with all the participants, before and after the meeting (Demiris et al., 2008).

7.3. Recommendations

Now that the information exchange map has been designed and a set of information sharing rules have been laid out, the question arises how these solutions will help the project to improve the information flows. Following a set of recommendations are addressed to managers in the project.

1. **Gradually switch on to use information exchange map designed for the project:** The information exchange map designed collectively with all the key stakeholders. Sharing the map with all the key stakeholders will bring everyone on the same page and will lead towards a standardized process. The

2. **The implementation of information sharing rules will have a huge impact:** The current information sharing in the project meetings is not very structured. These rules will help decide the meeting proceeding and make the time and information shared more efficient.

3. **Importance of the implementation plan:** It is important to inform all the respective stakeholders about the information exchange map and meeting rules. It is necessary to explain the reason why the changes were made and what is in it for them. An implementation plan will help the stakeholders to soak up the information and save any unforeseen dilemma or ambiguity.

    a. Follow the information sharing rules to disseminate the new design. It will check the validity of the proposed rules.
    b. The project manager manager SCW or Pune should facilitate the meeting and make sure all the rules are followed.
    c. The information exchange map should be introduced in each of the meetings. All the doubts and queries should move from level 1 meetings to level 3 meetings. All the changes made in the new information map should be listed out and their importance should be explained.
    d. Perform a dry run of information exchange map by explaining the movement of information right from the start of the customer request, so that everyone is aware of all the processes.
    e. Place the final design in the officially shared drive along with the meeting rules. Make sure everyone has access to the material on the shared drive.

4. **Need for centralized information system:** The current design revolve around information management amongst human resources and not IT systems. Hence, the IT systems need to be managed the same way, a lot of information is scattered and not used to its full potential. It is recommended that the managerial team in the case company should work together to converge all the information at one place to make most of it. There is a need for a centralized information system that should enable the central data collection and help the managers to make informed decisions. It is recommended that the managerial team in the case company should work together to achieve a control tower in the future. Control tower is an interesting approach for a new distribution system accompanied by centralization of the IT system hubs. It helps to control flows strongly and can help to organize or schedule supply at much earlier stages. E.g., lead-time for sea-freight is very long but then it is possible to load goods that are still not ordered for a specific area but could be forecasted for a larger region. It will reduce cost, reduce environmental impact and increase delivery service (Aronsson & Huge Brodin, 2006). The main focus of control towers in to increase supply chain visibility. It enables three controls strategic (overall design of supply chain network), tactical (proactive planning), and operational (real-time transport, inventory monitoring, and management). Setting up a control tower requires the integration of different systems with each other. All the information is collected centrally and used for auditing, monitoring and taking an effective decision (Bhosle et al., 2011).

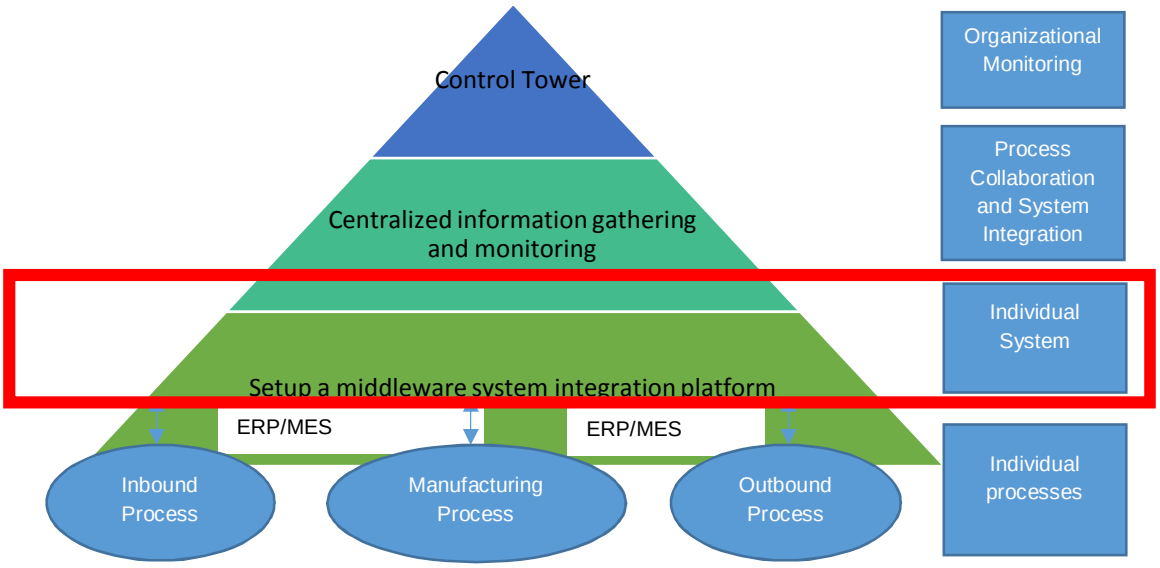


Figure 7.2 – Pictorial representation of Control Tower adapted from (Bhosle et al., 2011)

Figure 7.2 represents a control tower. Currently, the case company has all the individual processes and the next target should be to create a platform for integration of all the individual processes. The results of this thesis help to bring together the information flow by the information exchange maps. The information exchange map developed visualizes the flows and defines the information exchange in the project; this input can be used while designing the platform for integration.

8

Conclusion & Discussion

8.1. Conclusion

It was established at the start of the thesis that the information exchange in the project P2S of the case company is facing many issues according to the logistics manager of the case company. Hence, the design objective of this thesis was framed as

"To design an information exchange map using a business process model to improve information flows between the processes in the customer to customer process for the logistics departments of the case company."

Overall insight

A participatory design approach has been used in the thesis during which the design was built together with the stakeholders of the company by including their feedback to constantly improve the design as per their needs. An expert panel comprising of top-level managers of the company validated the final design. It was established during the meeting that the information exchange map explicitly defines all the major processes, roles and responsibilities for the project. This will lower the transaction cost of coordination for the company and will make the operations smoother. The overall idea of this thesis was to give insight into the issues regarding the information exchange in the project P2S to all of the stakeholders and present a solution, which fulfill all the major needs. The final design will lay a foundation for the information exchange within the project P2S for starting the planned serial production for the future.

AS-IS Map

AS-IS map was created to facilitate the final design because currently there is no detailed map available which can depict the processes with the customer to customer process of project P2S. It also meets the sub goal for the design objective

"Create a map to visualize the information flows in the current scenario."

The AS-IS map helped to visualize the issues at present or potential concerns for the customer-to-customer process. The analysis from the map, together with the results from interviews and observation were converged and data triangulation was performed. The map is an important deliverable to the company as it visualizes the current scenario of the case company that was not available before.

Need for the RACI aware BP

RACI (responsible, accountable, consult and inform) matrix together with business process (BP) proves to be the key method to design the information exchange map. The top issues found from the interviews and observations were to have defined information flows in the processes and defined roles and responsibilities in the project. The RACI ware BP was found to be the appropriate method of this thesis. It defined both the needs (listed above) and visualize them in a single diagram. Business process modelling notations are used to map the business process which is an industry standard and has been used in the other projects of the case company. Inclusion of RACI in the business process model helps to visualize the information exchange together with roles and responsibilities. It saves time by not having to refer the two charts i.e. a business process chart and a RACI matrix, as both are included in the proposed method. Also being present together in the same place makes it easier to follow for the users.

Roles of information sharing rules in the meetings and information pull

The results from the interviews and observation show that issues of redundant communication and waiting time for information is equally pressing. The main media for information sharing across the teams was found to be meetings. The information shared during these meetings is not very effective. It can be judged from the fact that despite having communicated information in the meeting the same information was requested repeatedly. Another big problem for these meetings was the number of participants attending the meeting and their relevance. To enhance the effectiveness of the meetings, information-sharing rules were presented. These rules were well received and were acknowledged as very significant by the functional manager of the project. The meeting rules and structure will help to fix a few indecisive elements - documentation, invitees, and access to the meeting documents. The structuring of meetings will save a lot of time and effort wasted in redundancy, thereby the transaction cost of performing activities will be reduced as compared to the existing information exchange

For the timeliness of information, the concept of information pull was used. At every instance where a foreseen delay could be observed for the delivery of goods, information flow was added which requests the due information to be informed to a

specific actor. Moving of all the information to this actor makes it centrally connected and updated on all the fronts. This actor is the point of contact for the team in SCW and service provider. Information is also requested from the central actor to update the SCW. This task of this actor was discussed mutually during the participatory discussions and was mutually agreed. With the help of information pull, it will be possible to have timely updates on any potential delays or issues.

8.2. Limitations

Case Study Limitations

Location Constraint: The two major teams and the respective stakeholders are located at different locations. Seven departments/group of stakeholders are represented in the final design. Out of which four departments are in Pune. The interactions with these departments and the respective stakeholders were done over email and Skype calls. Often it was a challenge to connect the stakeholders due to the limited time of this thesis. It was felt that there is a relative advantage during face-to-face interaction than the interactions over calls or emails. The stakeholders were more at ease and could provide more information during face-to-face interactions. For understanding the stakeholders in Pune, it would have been more easy and effective if it was possible to visit them in person and observe the setup in person rather than what others describe it.

Cultural Differences: A major pattern was noticed during the calls with stakeholders in Pune, was that they answered every question with a default positive mode which can be associated with cultural influence. Being an Indian (author), it was observed that Indians did not prefer to pin point and were indirect in their approach of feedback, Germans on the other hand were quite direct and straightforward. For an instance, upon asking, ñHas there been a problem understanding the inputs given by SCW or has there been any redundancy in information exchange recently? They replied no, everything is fine. While on the other hand, the executive from SCW mentioned that, the same information was asked repeatedly and an email was shown as a proof validating the instance. Since it was not possible to attach the email, but the response has been recorded, Appendix 2. The attendance was also an issue during data collection ï interviews and discussion. Stakeholders accepted meetings twice but did not show up. At another instance, while interviewing a departmental manager, it was informally mentioned that it is not right to comment what are the problems in the project, as it will point fingers to someone else, which is immoral. Upon further explanation by the interviewer that there has to be no pinpointing to an individual but rather discussing the issues in general and opinions about how things should be ideal or what can be done to work out the problem, the interviewee still chose to give answers which showed that everything is working fine and there are no issues. Hence a reluctance could be seen from the stakeholders while answering the questions. To collect unbiased data, some of these interviews were discarded, Appendix 2.

Design Limitations

- The final design is proposed in the context of logistics concept provided by the logistics department during the start of the thesis. Hence, the validity of the design depends upon the logistics concepts. If it were changed, the information map will no longer be completely true.
- Hammer and Stevenson mentioned in their report that the even after the process integration companies have failed to provide desirable results because the power concentration does not change in the department or the in the company overall. Hence, the power difference has to be mapped out of the picture to realize process integration (Hammer and Stevenson, 1999).
- In the current design, selected issues about transparency, accessibility and timeliness fulfilled. However, changing the dimensions of one integration principle could affect the other dimensions. It is not certain how issues related to granularity have changed by changing the other three dimensions.

8.3. Future Work

Principles of Process Integration

The principles of process integration explain that there are four basic principles, which has to be addressed to strengthen the information flow in an organization. However, often information exchange across departments of a company depends on two characteristics ï level of interaction and level of collaboration required for an activity to be coordinated. It can vary as per the function or department of an organization. Interdepartmental interaction deals with communication aspects such as meeting, phone calls, fax, teleconferencing, etc. Interdepartmental collaboration is the willingness to work together by having mutual understanding, sharing vision and resources, etc. (Kahn & Mentzer, 1996). The model described below shows examples of what kind of collaboration or interaction is required during different stages of the project. Hence, the information exchange across departments is not the same at all times. The relevance of information exchange can differ for different stages, hence a different combination of accessibility, timeliness, transparency and granularity is needed for a different stage of the project.

Table 8.1 – Logistics integration with other departments (Kahn & Mentzer, 1996)

High Interaction	Stable product line Stable market Available time Lower uncertainty	Complex products Complex orders Mission critical items Key customer accounts
Low Interaction	Department specific activities Third party logistics	Product launches New facility parameters Special customer orders High uncertainty Short term episode
	Low collaboration	High Collaboration

8.4. Answering Thesis Method Objectives

1. Analysis and Definition

This design objective has been answered by a thorough literature review, interview and observations of the stakeholders. The literature review was done to understand the theories and concepts defined in the literature in the context of information flows and its various implications. It was concluded with a theoretical framework. Interviews and observations were based on the findings from the literature and were checked for its validity in the context of the case company. An AS-IS map was developed to visualize issues in the current customer to customer process. The analysis gave valuable input for further data triangulation. Design requirements were defined after the analysis of the data observed from the interviews and observations. The data triangulation demonstrated the top priority issues present in the project P2S. These issues were put together to identify design requirements. There were four design needs identified which should be a part of the final design and recommendations.

2. Generate conceptual design(s)

The conceptual design involved desk research to find the state of the art methods, techniques present in the literature, and how they fit in the context of the case company. Based on the primary findings from the literature, participatory discussions were held to further work on the conceptual design. The result of every discussion was validated by the next discussion. During the participatory design discussion with the managers, the AS-IS diagram was validated and ideas for improvements were discussed. Finally, all the feedback gathered during the discussion were included in the design to form an updated customer to customer process. A requirement check was done to make sure all the design needs were met.

3. Design Validation and the final design

The last participatory discussion was an expert panel that helped to validate the design. The expert panel included all the managers who are the drivers of the project and brought them together to discuss the updated design. After a couple of suggestions, the meeting was concluded and final improvements were proposed by mutual agreement of all the stakeholders. All the suggestions were included in the design to make the final design. The final design together with meeting rules and structure were the deliverables to the case company.

4. Provide recommendations and discuss results

After the final design, all the recommendations were laid down for the case company. It included the usage of the design together with information sharing rules and structure for meetings. Later, limitations and future work were discussed.

9

Reflection

It is imperative that results were examined to give recommendations, it is important to reflect back and learn the implications. It can be achieved by understanding the choices made in the context of thesis in Section 9.1, followed by understanding the effect on existing research in Section 9.2 and finally, summing up all together in Section 9.3.

9.1. Personal motivation and method choices

Reflecting back on the research and approach in this thesis, especially while comparing it from the initial proposal and the final version. There has been many ups and downs. One thing was very clear that it that the scale and impact of this project are much greater than what I assumed. There were a few things, which I might have missed while executing this project.

To start with, the method chosen for this thesis ï a participatory design approach comes from the personal interest of the author. There has always been a motivation to work on real life projects where its theoretical learnings can be applied. There was been immense óinformation flowôwhile learning from the employees (interviews and observation) of the organization, professors (feedbacks and suggestions) from the university and the research literature. There was always an interest to work on practical problems and work towards a solution. There is one major take away from this thesis was that the methods have limitations but the way to use them can have limitations too. For instance, it was not completely possible to rule out all the biases from the interviews. Interviews take a lot of time and if they are not structured or captured properly, there is a high chance to miss out something very important. For participatory discussions, it is important to steer the discussion to lead to a result. Often, due to time limitation, there could be no proper conclusion. An important thing learned was to use smartly the time during meetings by giving more time to the main points of discussion rather the secondary points. The high importance can be achieved by quickly introducing the main point rather than hovering around secondary points, as everyone will be in a fresh state of mind and could actively participate. About the methods used in this thesis, the literature gave insights on macro and micro level, the

interviews and observations gave insight on meso and micro level, and the participatory discussions gave insights on meso and macro level.

9.2. Existing researches

The literature over supply chain coordination, information flows, process integration, etc. all either focussed on a strategic level where many frameworks could be seen on a macro level or a very micro level. It is important to bridge the two worldsî macro and miso and understand or visualize different combinations. For example in this thesis, the process integration, information flows, standardization, business process models, RACI charts and information sharing rules are related. It can be understood maybe it is too much to contain all the things together, but it also creates a void between the macro and the micro level.

9.3. Conclusion

In summary, there has been a lot of learning and ups and downs during this thesis. With every insight gained, there was a development of new ideas. Figure 8.1 depicts the changing viewpoints of the author with different methods used over time. The personal motivation and interest were shaped along with the thesis by research literature, interviews, observations, and participatory discussions.

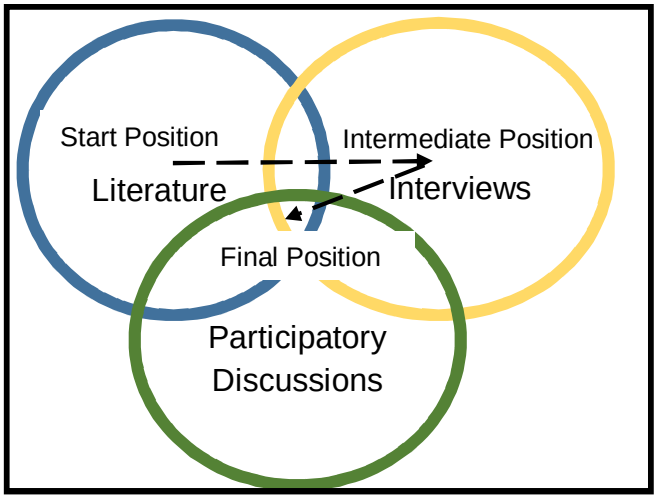


Figure 9.1 – Author's viewpoints across the thesis

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Appendix

1

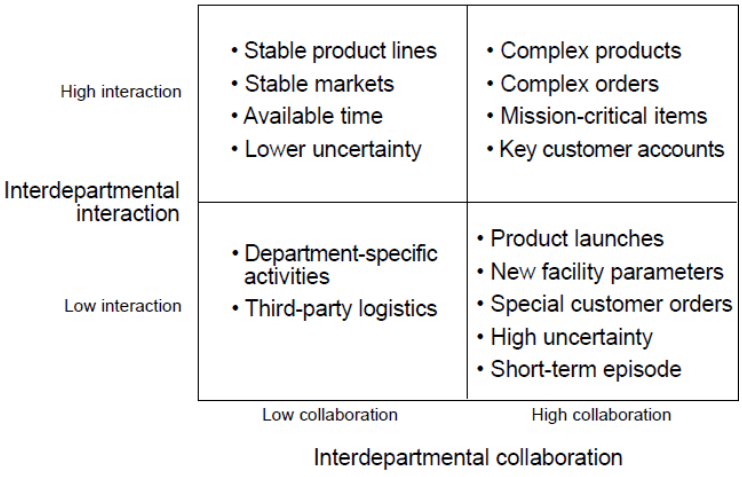
Theories and Literature

A1.1. Technical Terms Explanation

Technical Terms	Description	Literature Sources
Power Distance	It is the egalitarian interaction versus high power (superior) ï low power (subordinate) limited interaction relationship between superiors and subordinates.	(Sekaran & Bougie, 2016)

A1.2. Frameworks from Literature

- Framework for information integration based on interaction and collaboration (Kahn & Mentzer, 1996)



- Strength and weakness of sources of evidence (Yin, 1994)

Sources of Evidence	Strengths	Weakness
Documentation (company email conversations and proposals)	Can be reviewed when needed Exactness, long span of time	Reporting biases Blocked access Accessibility issues
Interviews	Focused, insightful	Bias due to poor construction of questions, response bias, reflexivity ï answers based on what interviewer wants to hear
Participant Observation	Reality ï covers real scenario, insightful into interpersonal behavior	Time consuming, reflexivity

2

Empirical Analysis: Interviews and Observations

2.1. Interviewee Description

To decide the interviewees, all the departments in the present customer-to-customer process in ZF SCW and planned customer-to-customer process including the ZF Pune and ZF SCW were considered. The primary departments are namely: Sales, Order Processing, Program Planning, Material Planning- Purchasing, Goods Receipt, Production and Assembly, Dispatch and Distribution, Customer Service and IT. The warehouse service provider is not fixed but the manager responsible was well informed and hence the manager provided answers from the perspective of the service provider. Additionally, the case study organization prefers not to interview customers, hence the customer care employee who has been in contact with one of the customer since the development of the project provided answers on behalf of the customer. The interviewees were chosen from three different categories:

1. ZF Managers
2. ZF Operators
3. ZF Approved Service Providers & Customer

2.2. Interview Designing

The interview was designed with respect to different literature studied during the literature review and from the discussion with my company supervisors and colleagues. It was aimed to check the factors used in the proposed framework and validate them. Further, the interview was conducted in two phases ï 1. Preliminary interviews were unstructured interviews and observation. 2. Structured Interview with a questionnaire.

2.2.1. Preliminary Interview and Observation

During the stage of problem statement and proposal consolidation, to understand the overview of the project from the perspective of employees working in the logistics department a preliminary interview was conducted. The interview was performed in an unstructured way with open-ended questions to probe into the broad problem areas. There were also follow up interviews based on the need for further investigation. Participant observation, a method where the researcher collects data by participating in the daily activity of an organization, was another used method to understand the daily activities of the selected employees. The employees selected were based on the recommendation of the authorôs company supervisor, highly experienced employees and the usage of the English language. The degree of participation was a moderate one, where data was collected and recorded with occasional interaction with the stakeholders of the company. The participation includes ï plant visit, the know-how of the production system, current operations and logistics involved in the projects, observing employees during client calls/updates, etc. (Sekaran & Bougie, 2016).

Questions:

- Please tell me about your department and your work
- I would like to know more about project P2S. How your work is related to the project P2S?
- Compared to other projects what are the things you like or dislike about the project P2S?
- Who else from your colleagues are actively involved with this project?
- What are the criteria to measure the success or failure of your work?

2.2.2. Linking Theory to Interview Questionnaire

The different factors identified are listed in the table below.

Table 2.1 – List of factors to detailed interview parameters for ZF Operators (Pune & SCW)

Accessibility and Timeliness(A)	
A1- Existing Scenario	Overall Picture. Current Supply chain Map with responsible department and personnel.
A2- Project Attributes ï Ideal State	Positive and Negative attributes in respect to an ideal state from actors viewpoint.
A3- Issues	Current gaps from actors viewpoint
Communication Granularity (C)	
C1- Existing	Current method used and their effectiveness
C2- User Preferences ï Ideal State	Preferred type of communication ï formal/informal
C3- Need	Level of required communication in current processes
Transparency (T)	
T1- Current Transparency	Current transparency in the process and benefits
T2- User Preferences	Preference on standardization
T3- Need	Level of transparency required in current processes

Table 2.2 – List of factors to detailed interview parameters for ZF Managers (Pune & SCW)

Accessibility and Timeliness(A)	
A1- Attributes ï Existing Scenario	Overall Picture
A2- Project Attributes ï Ideal State	Positive and Negative attributes in respect to an ideal state from actors viewpoint.
A3- Issues	Areas of concern or department of concern
Communication (C) - Granularity	
C1- Existing Methods	Current method used and their effectiveness
C2- Attributes	Attributes of current coordination scheme
C3- Need	Level of Visibility, Control, Standard Processes, Information exchange
Transparency (T)	
T1- Current Transparency	Current transparency in the process and benefits
T2- User Preferences	Preference on standardization, relation between standardization and transparency
T3- Need	Level of transparency required in current processes
Process Integration (PI)	
PI1- Integration Elements	Constituents of integration
PI2- Priority	Current focus element

Table 2.3 – List of factors to detailed interview parameters for Service Providers and Customers

Accessibility and Timeliness(A)	
A1- Attributes ï Existing Scenario	Positive and Negative attributes from actors viewpoint
A2- Issues	Areas of concern or department of concern
Communication (C) - Granularity	
C1- Existing Methods	Current method used and their effectiveness
C2- Need	Level of required coordination characteristics in current processes
Transparency (T)	
T1- Current Transparency	Current transparency in the process and benefits
T2- Need	Level of transparency required in current processes

2.2.3. Qualitative Interviewing and Biases

Based on the book Research Methods for business by Uma Sekaran and key elements learned in Research Method lecture, important guidelines were considered. All the points mentioned below are directly taken from literature

- When it is required to solve a particular problem in a work setting, the totality of the situation has to be understood.
- The interviews may be conducted at several levels ï in start interviewing with open questions helps to identify perceptions.
- Different questions have to be asked according to job type and level of work done by the interviewee.

- Unstructured interviews help to probe into several factors that could further be pursued by structured interviews to find more in depth information.
- The interviewer can bias the data if trust and rapport are not established with the interviewee or when interviewer discourages a certain type of response by facial expressions or gestures.
- Biases could be situational ï non-participation or trust/rapport with interviewee or the physical setting of the interview.
- Biases can be reduced by asking consistent questions or falsifying information received or rephrasing and clarifying again.

2.3. Interview Questionnaire

The interview was conducted after booking an appointment with the interviewee and the questionnaire was sent out a few minutes before the meeting. As the interviewees were generally, very busy so a time slot was booked for every interview and all the responses were recorded during the interview. Thus avoiding redundancy and saved time.

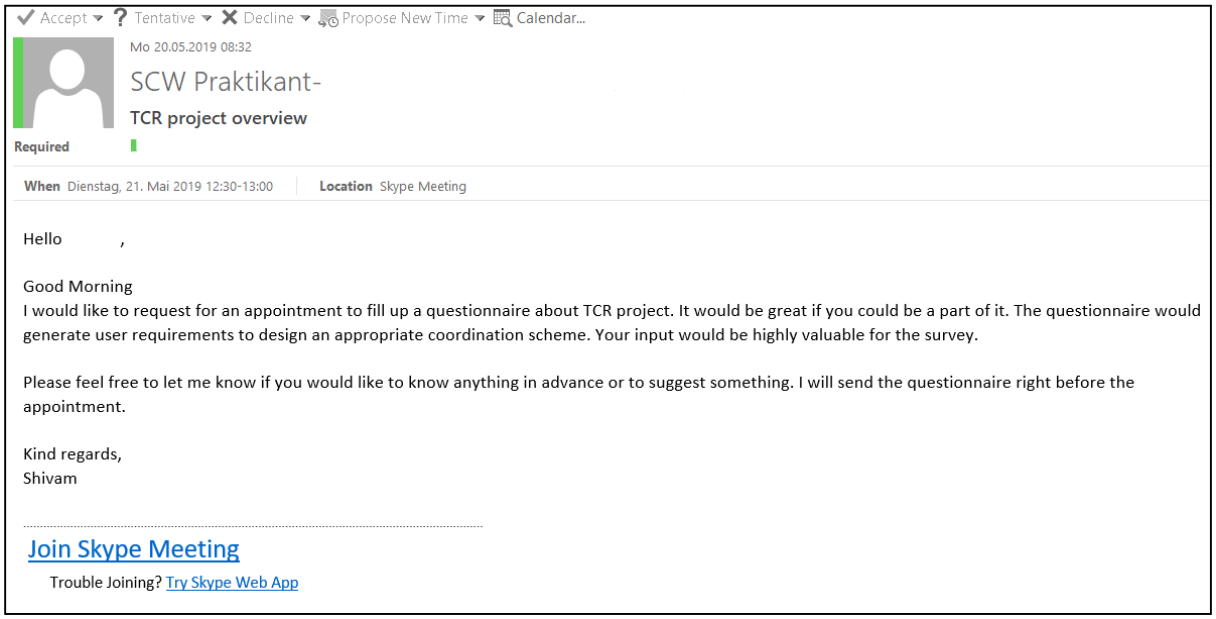


Figure 2.1 – Email Introduction sent to Participants

Figure 2.3 ï 2.8 are the interview questionnaires for five different categories of stakeholders.

1. Managers
2. Operators
3. Operators (IT)
4. Service Providers
5. Customer

A supply chain network diagram was made to guide the interviewees and the interviews (figure 2.2)

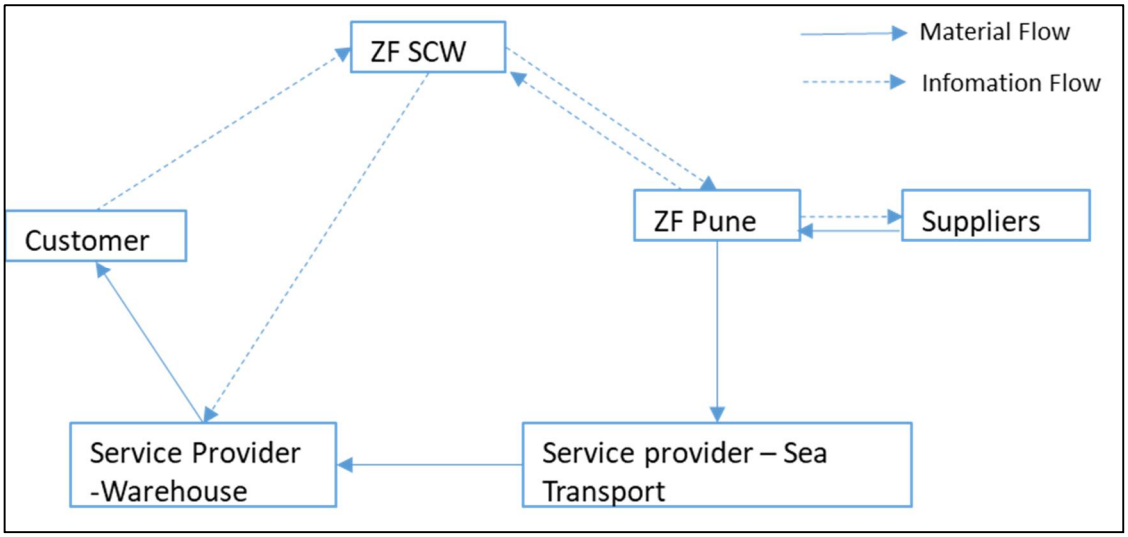


Figure 2.2 – Supply Chain Network Diagram for project P2S

2.4. Interview Results

Logistics- Customer Delivery- SCM - Functional Expert (Pune)

Preliminary Interview:

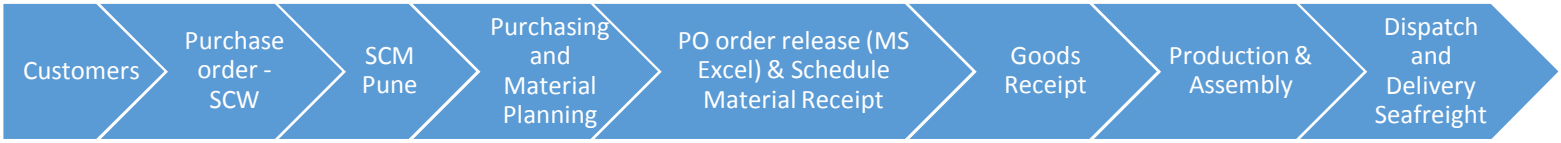
- Responsible for logistics activity ï taking care of good receipt notes, material feeding and production line feeding. In charge of material movement including plant logistics, packaging and its material.
- Customer delivery is scheduled every month for customers. Customer usually has a buffer stock depending upon its location. If the customer is close than it maintains low inventory for an instance two days or so, this means frequent milk runs to the customer. For customer at distance location, bulk delivery is made.
- The project P2S has been proposed recently and there are preparations going on to make it work. Responsibilities are not clear yet, but this is how things work in the start. Not sure about what would be the responsibilities.
- Purchase Manager, IT Manager working on Navision will be involved in this project.
- KPIs are followed to measure the success or failure of the work.

2.4.1. AS-IS information flow in the customer to customer process

- The process flow at ZF Pune as defined by Logistics Team Pune:

- The overall process flow as defined by IT Team Pune:

- The overall process flow as defined by Purchasing Team Pune:



2.4.2. Data collection from Stakeholders

All the data collected from different category of stakeholders is presented in the pictures below.

	Respective Functional Departments - Operators ZF									
Categories	Logistics & Dispatch- Pune	IT SCW	Purchasing and Material Planning SCW	Order Processing SCW	IT Support Pune	Purchasing and Material Planning Pune	Production and Operations - Pune	Marketing Sales - Head - SCW	Project Lead TCR Project SCW	Common Issues
Accessibility and Timeliness - Existing State	Good overall coordination.	SCW is fine. Pune not sure.	No Purchase orders are received from Pune on time.	Not very smooth process, need to check over and over . Schedule not on time . No clear explanation for delay.	Still working on to clear some aspects but all good now.	Initial phases on projects but things will clear out soon. No problems as of now.	No production schedule till date. Slow ramp up of the production. Overall picture is clear. No problem with production, whole project could be much better. Not enough time to plan project which lead to poor selection of resources.	Accessibility and timeliness is okay for the moment but it needs improvement. It was difficult in the start but now things are getting better.	Missing tooling, parts and people. Fluctuation in teams. A few people left as well. Exchange of information is a problem . Different people in different meetings, significant time delays, lot of hierarchy - seven people give approval for a PO release. Multiple locations and lot of stakeholders, need for timely escalations to keep check, authority	1. Checking for correctness, 2. Documenting work redundantly, 3.Waiting for information, 4. Need for clarification, 5. Unclear information flow 6. Planning & Estimation 7. Finding right person, 8. Transferring of information from one department to another
Accessibility and Timeliness - Ideal State	100% Customer schedule compliance. No air freight deliveries.	ERP systems at both places should be able to receive and send EDI	EDI should be working to receive and send orders.	All the work should be on time as planned or recommended. Visibility for what is in transit and when it arrives.	Everyone involved has a clear understanding and know what happens when	Everything should be clear and transparent	Have a proper schedule and time to prepare an order with all resources in place.	Both the teams in SCW and Pune should work together to realize the planned volumes and hence generate profit for the company	All teams know what they want to do and are proactive in their tasks.	NA
Accessibility and Timeliness - Need	Advance Planning for coordination	EDI Process has to be established	Pune should be able to place orders directly.	On time delivery, clear understanding and time line adherence	Need to plan the exact requirements and put it down for everyone.	Transparency and control on the process flow.	Areas of concern are Sales planning and material planning. There is a need to monitors closely and be careful with these processes . ZF SCW should have clarity about customer, ZF pune should be careful with material planning by carefully managing lead time.)	More communication to the client and to the respective project teams in the company. It has to improve to make it more smoother.	Need for higher transparency , accessibility and timeliness	Need for high punctuality and accessibility of information. Need for ERP and EDI
Communication Granularity - Existing State	Email, Meetings, Calls. Both formal and informal methods work very well.	Not relevant	Email, Meetings, Calls. Both formal and informal methods work very well in SCW. For Pune formal works better.	No effective Communication Granularity. Work via calls, skype meetings etc. connectivity is good. People are nice.	Call emails and meetings. And it works well.	Email and skype and it works very well. Friendly relations with counterparts in SCW.	Weekly meetings for discussions to check the volumes of production and hiccups. Shared folder, tracking sheet with all the responsibilities included in the sheet.	Meetings , Email and skype. It works quite well	Meetings, email and skype. Face to face interaction. No clear communication. It is not understood as it is meant to be. Meetings and face to face interaction is not enough.	1. Incomplete information 2. Unspecific communication

Figure 2.8 – Combined interview results for operators/functional experts

Communication Granularity - Ideal State	Same.	Not relevant	Informal is easy to deal.	Mutually understood and agreed tasks and compliance	flow of right level of information and common	Communication is highly related to coordination.	Same as existing	Everyone is updated and works together	Everyone is updated and works together	NA
Communication Granularity - Need	All good for now.	Not relevant	Effective communication.	Adherence to the communicated task or work.	All good for now.	All good for now. High Informal communication is required in the start of projects.	All good for now.	High need to communication between clients and sales executive and sales executive and the concerned departments.	High need for effective communication	Need efficient communication, adherence to agreed information. Common understanding is required.
Transparency - Existing State	Very transparent processes. Not clear about project XXX.	Existing processes in SCW are very standard.	Transparent process in SCW internal. No transparency in P2S project.	No clear visibility on process of Pune and not aware who will do what.	People on job know their responsibilities	Existing processes in SCW are very standard.	All the processes and systems are according to ZF standard.	It is quite standardized. Customer quotations and other sales software to help the detail planning are present	Production is standard. Not the information exchange. Redundant communication. Not sure about the information flow	1. Unclear information exchanges, 2. Redundant communication 3. Need for clarification
Transparency- Ideal State	Highly standardized processes.	All the processes should be standardized as it helps IT and business.	Communication helps in creating	Standardized process and clear responsibilities.	Standard process should be known, implemented and followed	Standardized process and clear responsibilities.	The processes can be more standardized.	Highly standardized processes	collect data, check and improve and then define and write and communicate. Different ways for present.	NA
Transparency - Need	Higher level of Transparency is required.	Ideally yes, but not sure.	Higher level of Transparency is required.	Higher level of Transparency is required.	Process have to be standardized.	Higher level of Transparency is required.	Higher level of Transparency is required.	More Transparency would be great.	High need. Currently there is no standardized information flow.	Need high transparency and standardization
Suggestions					Project tracker with detailed steps and responsibilities .			Need to understand the customer specifications or request clearly by both the parties.	Pune should initiate the work but ZF SCW does it on their behalf. Provision should be made to facilitate it.	NA
Interviewer Comments	Few answer were in conflict with each other. Sometimes dodged the questions on further probing	Precise answers and very clear explanation	Clear explanation.	Clear explanation	Positive attitude and clear explanation. Politically correct answers.	Positive attitude and clear explanation. Politically correct answers.	Clear explanation	Clear explanation	Clear explanation	NA

Figure 2.8 – Combined interview results for operators/functional experts (contd.)

	Managers ZF					
Categories	Functional Manager SCW	Functional Manager Pune	Project Manager SCW	Project Manager Pune	Manager- Process Expert-Logistics SCW	Common Issues
Accessibility and Timeliness - Existing State (areas of concern)	Not very clear - working towards it.	Complete clarity - the numbers volumes and part numbers. Not sure if it is right. We have something but we are not sure about it. Schweinfurt not clear - sales?? We need enough time for customer orders so that we can plan test prod etc. As of now only clarity for other customers. More customers are already planned but not sure about the numbers.	The picture of information flow is clear - but specific roles are not, yet! A lot of people attend meeting which is not necessary. Lot of waiting time from Pune. The counterparts in Pune does not seems to be on the same page as SCW. Understanding the communication is not very great on both the sides. SCW faces customer so they are very sensitive and keen about this project, but it feels Pune doesn't feels the same. Communication is not very specific and not hard followed.	Still working on to clear some aspects but all good for now. The areas of concern would be operations in Pune.	ZR SCW and Warehouse Service Provider	1.Waiting for information, 2. Need for clarification, 3. Unclear information flow, 4. Finding right contact person 5. Difference in understanding 6. Redundant communication
Accessibility and Timeliness - Ideal State	Partnership and collaborative working is important	Partnership and collaborative working is important	Roles and responsibilities are mapped out correctly.	All roles and responsibilities are mapped out.	Shipments delivered from Pune to Europe on time.	NA
Accessibility and Timeliness - Need (Gaps in Project)	Schedule time frame is critical and high management focus.	Sometimes we get information in bits and pieces. Small gaps- internal process - tedious processes in Pune	Roles and responsibilities are not clear	No Gaps	Black Box - Navision ERP system in Pune	1. Waiting for information 2. Inconsistency in usage of ERP system
Communication Granularity - Existing State	Low. Difference in understanding and not being specific enough.	Good support from colleagues SCW,	Moderate to Low - not specific and sometimes incomplete	Good	Not a good level. Sometimes difference in understanding	1. Communication incomplete and not specific 2. Difference in understanding
Communication Granularity - Ideal	High coordination level of Material and Information flow	high coordination level of Material and Information flow	high coordination level of Material and Information flow	high coordination level of Material and Information flow	Information flow would make things much nicer.	Need to focus on information and material flow
Coordination - Need	High	High	High	High	High	High need of concise and clear communication
Transparency - Existing State	Moderate	Moderate	Low	Moderate	Moderate Level of transparency	NA
Transparency - Ideal State	High	High	High	High	High Level of transparency	NA
Transparency - Need	Increase in transparency	Increase in transparency	Increase in transparency	Increase in transparency	Increase in transparency	Higher level of transparency required
Process Integration -Requirements	High increase visibility and control,	Increase in visibility and information exchange	high visibility, control, standard processes, information exchange and flexibility	Increase in visibility, control, standard processes and	Information flow is high priority.	Process integration is highly required. Information flow should be the priority. Need -higher
Suggestions	IT system is like a oil tanker. Too slow to react to changes.	NA	Information flow is priority (material flow follow!)	NA	Information flow transparency + follow the rules of processes	NA
Interviewer Comments	Clear and straightforward	Clear and straightforward	Clear and straightforward	Politically correct answers	Clear and straightforward	NA

Figure 2.9 – Combined interview results for managers

	ZF Approved Service Providers and First Customer for Project XXX			
Categories	Warehouse (Answered by logistics planner at ZF SCW)	Shipping Company - Head of Ocean freight	Customer (Combined input given by Customer Care and sales department)	Common Issues
Accessibility and Timeliness - Existing State	Warehouse logistics planner connects with Dispatch department of the project in SCW. Easily accessible and on-time response.	Have not started the serial delivery. But all the points of contacts are available. The delivery process is very standard and clear.	No problem at the moment. Delay in sample parts. Until now, the delivery has been on time and customer care was always accessible.	NA
Accessibility and Timeliness - Area of concern	Not a lot of safety stock. Two days for delivery.	Communication flow	Warehouse delivery because they have two days to react for a shipment based on the dispatch information given by dispatch department at SCW.	NA
Communication Granularity - Existing State	Good partnership. All paper works are very clear	There is a lot of communication flow required, therefore it's extremely necessary to keep every party up-to-date. Internal tracking to shipments. Customer is informed on shipment basis about the further milestones of each shipment. If there a significant changed within the transport period, customer is informed by Schenker.	Good and clear information flow so all good.	NA
Communication Granularity - Need	High	Low	High	NA
Transparency - Existing State	High	There is a kind of standard procedure which the necessary arrangements are based on. Within ad-hoc shipments there is a bit more communication necessary to handle the shipments to keep the customer satisfied.	Not sure about how the process works and not required.	NA
Transparency - Need	Low	Low	Low	NA
Suggestions	NA	NA	NA	NA
Interviewer Comments	Clear and straightforward. A lot of insights from the warehouse company	Clear answers	A sales and customer care executive posed as customer, being the only point of contact.	NA

Figure 2.10 – Combined interview results for service providers and customer

2.5. Participant Observation

The observations carried out in descriptive and selective observation stages are mentioned below.

Objectives	Observations	Issues
Space layout	Logistics department of the company co-located with the production unit	NA
Object	ERP systems, communication tool (skype), internal project trackers, company documents, shopfloor management tools such as board to write down KPI's for activities by different department, three level of shopfloor meetings - operational level, cross departmental, and top manager level meetings,	NA
Actors relevant detail	Functional Manager SCW - working since the start of project xxx, Functional Manager Pune - working since the start of project xxx, Logistics Manager SCW - working since the start of the project xxx, Logistics Manager Pune - working since the start of the project xxx, Functional experts SCW and Pune working since the start of the project XXX. All the managers observed were the part of the project xxx.	NA
Events	Overview of the production facility, three weekly project meetings, 19 structured interviews	NA
Sequence	Overview of the production facility - fifteen (15) structured interviews - weekly meeting 1 and 2 - four structured interviews	NA
Feelings/action /activities of actors	Functional Manager SCW - "We want Pune to plan things for themselves and be independent but its not happening for now." Functional Manager Pune - "We need complete clarity on volume and part numbers. We have some information but we are not sure about it. " Logistics Manager SCW -"I have talked to 5 or 6 different people regarding purchase order release in Pune but not sure who is responsible for it" . Logistics Manager Pune - " Everything is working fine and all good." Functional expert Purchasing/Order Processing SCW - "I have mentioned same details to the same group of people many time but they are still not sure about it and have asked us again the same thing ." Functional Expert, Purchasing, Pune - "There is always few problems during the start of the project but everything will okay." The participant observer was also included in an execution of a small task - request of quotation proposal for packaging boxes. During the task execution, an interaction was made with a dispatch and delivery functional expert over email and skype. There was a delay with respect to the agreed mutual deadline. No timely notification for delay was provided. The supporting document sent from the observer had two different information for same product. The proposal sent by the functional expert was entirely different as well. A follow up was made to correct all the errors. The time span elapsed was two and half weeks while originally the time requirement was one week. But the information delay did not have any affect as the overall scheduled production is delayed for months.	1. Need more information 2. Finding correct information source 3. Requiring further clarification 4. Documenting work redundantly 5. Waiting for information 6. Incorrect documentation and correction 7. Clarification for same information
Human Traffic	Overview meetings and interviews were one to one meetings. 1st Weekly project meeting - 16 participants, 2nd Weekly meeting - 22 participants, 3rd Weekly meeting - 20 participants. Twice in three meetings relevant department heads were absent and were represented by other members.	1. Waiting for personnel. 2. Transferring of information from one person to another 3. Undefined roles and responsibilities
People who Stand out	During project meetings - the functional manager Pune had to often intervene and take command to drive proceedings. During project meeting a Team Member in Pune " Please ask other departments to also cooperate with this as well."	1. Checking for correctness 2. Requiring clarification or clarifying for others 3. Requesting coordination for an output data from one to another department
Verbal Behavior	During project meetings, the functional manager would take the command and fill up the tracker. People associated with the activity would speak up and update their status. During the interviews, the answers received from few team members contradicted their own previous answers , upon clarification the question was dodged.	1. Checking for correctness 2. Navigating for information

Figure 2.11 – Descriptive Observation adapted from (Spradley, 1980

Objectives	Observations	Issues
Story line based on events, actions and behavior of actors	The logistics team in SCW had planned and scheduled the delivery of final parts from Pune considering the time of production, and sea freight. But there is a significant delay in the delivery from Pune. As of now the team in Pune is not able to provide final parts on the expected schedule and the planned deliveries are postponed. Managers in SCW is currently stuggling to get right information from right person. Weekly Project Meetings are done in order to check if everyone is on the same page.	1 - Waiting for information 2. Finding information 3. Finding right person.
Sorting regular activities from irregular activities	Pune and SCW both have standard processes independently. There are weekly project meetings to update each other. Both the teams are working together to sort discrepancy in the information exchange. The regular activities done by SCW is to deal with customers based on the orders received, then the order processing team at SCW would place the order to Pune. Pune would manufacture and deliver the parts via sea freight to a warehouse organized by SCW. The warehouse would then deliver the order to the customer based on SCW's request.	NA
Variations in Story line	Order Processing SCW - "We are not sure about who would be our first point of contact in Pune." Production Manager Pune - "During the start of the project, a lot of things were done hastily . As a result a lot of equipments bought were not right. Also we need more time to plan. We do not have the production schedule yet for the production planned. We know the numbers but no production schedule till now"	1. Nagivating for people and information 2. Rework to match desired equipment 3. Waiting for information 4. Defining information flows in processes
Exceptions	In a recent case of sample part delivery, Sales SCW send the purchase order to Sales team in Pune and the sales team in Pune did not inform the SCM team Pune in time. As a result Pune did not manufacture the parts on priority and SCW struggled to meet their time schedule. But since the process for sample parts are defined and does not apply the same process as of serial production, it can be treated as an exception	1. Transferring data to incorrect department 2. Waiting for input information 3. Organizing information

Figure 2.12 – Selective Observation adapted from (DeWalt and DeWalt, 2002)